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AGRICULTURAL LEGISLATION OF 1934.

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LEGISLATION passed during the 1934 session of Parliament and directly or indirectly affecting the primary industries of the Dominion and those engaged in agricultural or pastoral pursuits is contained in the following Acts—viz., the Agriculture (Emergency Powers) Act, the Noxious Weeds Amendment Act, the Slaughtering and Inspection Amendment Act, and the Stock-remedies Act. In the following notes the provisions of the several Acts are reviewed. The notes are not intended to be exhaustive, and persons interested in any particular statute are advised to obtain a copy of the Act, which may be had on application to the Government Printer, Wellington, on payment of a small sum varying with the relative Act but not exceeding 9d. per copy.

AGRICULTURE (EMERGENCY POWERS) ACT, 1934.

The object of this statute is to provide for the establishment of an Executive Commission of Agriculture; to reconstitute the New Zealand Dairy-produce Control Board and extend its powers; and generally to enable effect to be given to the recommendations of the Royal Commission appointed last year to inquire into matters affecting the dairy industry of the Dominion. The Act is divided into four parts—viz., Part I, The Executive Commission of Agriculture; Part II, the New Zealand Dairy Board; Part III, financial provisions; and Part IV, enabling provisions.

PART I.

Under this Part a body called the Executive Commission of Agriculture is established, consisting of the Minister of Agriculture and three other members, the latter to be appointed by the Governor-General in Council for a period of five years. The Minister of Agriculture shall be the Chairman of the Commission, and a Deputy Chairman shall be appointed from among the other members, two of whom shall be persons who, at the date of their appointment, are or have been either actively engaged as producers in some branch of primary production, or actively engaged in the manufacture or marketing of primary products, or in some commercial or other undertaking closely associated with the production, manufacture, export, or marketing of primary products. No member of the Commission

except the Minister of Agriculture shall be engaged in any paid employment otherwise than as a member of the Commission. The personnel of the Commission, the appointment of the members of which was announced last month, is as follows: Hon. C. E. Macmillan, Minister of Agriculture, Chairman; His Honour Mr. Justice Frazer, Deputy-Chairman; George Duncan, Esq.; and David Jones, Esq.

The functions of the Commission are—(*a*) To co-ordinate the work of the several Boards and other authorities exercising powers with respect to any of the primary products of the Dominion; (*b*) to exercise any powers that may be transferred to it under section 7; (*c*) to make such recommendations to the Government as it thinks proper with a view to the making of regulations under Part IV; and (*d*) such other functions as may be lawfully conferred upon it by regulations under Part IV.

Under section 7 of the Act any powers now vested in the various Control Boards with respect to certain primary products—viz., meat, dairy-produce, fruit, honey, poultry, and eggs may by Order in Council be transferred to the Commission. No powers shall be so transferred, however, except after consultation between the Commission and the Board in which the powers are vested. On the transfer of any powers the Board in which the powers were vested may continue to exercise such powers with the authority of the Commission and subject to such conditions as the Commission may approve, but not otherwise. The expenses of the Commission shall be defrayed out of the funds of the Board or Boards whose powers and functions have been assumed by the Commission in such proportions as may be agreed upon, and, in cases of dispute, as determined by the Governor-General in Council. In any other case the expenses of the Commission may be paid out of moneys appropriated by Parliament.

PART II.

By Part II important amendments are made to the Dairy-produce Export Control Act, 1923. The Act should now be cited as the Dairy-produce Act, 1923, and the name of the Board established thereunder has been changed to the New Zealand Dairy Board. The term "dairy-produce," which by the principal Act means "butter and cheese," has been extended to include all other products of milk or cream whether produced by manufacturing processes or otherwise.

Provision is made for the reconstitution of the Board by providing for a reduction in the present membership from twelve to seven members, of whom three members shall be appointed by the Governor-General in Council, one by the New Zealand Co-operative Dairy Co., Ltd., and three members shall be elected by dairy companies, one for each of three wards into which the Dominion is divided for that purpose—viz., the Northern Ward, comprising approximately the northern half of the North Island; the Middle Ward, being the balance of the North Island, and the Southern Ward, being the South Island, Stewart Island, and the Chatham Islands. On a date to be fixed by the Governor-General in Council the present members of the Board shall go out of office and be succeeded by the members of the reconstituted Board.

Elections of the elective members shall be conducted by post, the voting by companies being expressed in terms of tonnage votes on

the basis of one vote for each ton of butter manufactured or its equivalent. Two tons of cheese or 2,000 lb. of butterfat comprised in any other manufactured product shall be the equivalent of 1 ton of butter. Detailed procedure in the conduct of the first elections of the elective members is contained in the Dairy Board Election Regulations, 1935, made under Part IV of the Act.

The Board may, in addition to its existing powers in relation to butter and cheese intended for export, but in accordance with regulations to be prescribed, regulate and control the production of dairy-produce in New Zealand and the handling, marketing, transport, and distribution of dairy-produce intended for local consumption. The Board may appoint committees to whom it may delegate its powers except the power to fix the amount of any levy which the Board may impose on dairy-produce. A person not being a member of the Board may be appointed to any such committee. The Board is empowered to fix, within the maximum levies prescribed by regulations under Part IV, the amount of any levy payable on dairy-produce manufactured for sale, whether subject to the control of the Board or not. Differential levies may be prescribed in respect of different kinds of dairy-produce, and in respect of dairy-produce exported and dairy-produce intended for local consumption.

PART III.

Part III of the Act authorizes the expenditure out of the Public Works Fund on such terms and conditions as may be prescribed by the Minister of Finance of moneys appropriated by Parliament for the rehabilitation of the dairy industry, and in particular for any of the following purposes: (*a*) The construction, reconstruction, equipment, and improvement of dairy factories; (*b*) securing improved conditions in and about dairies; (*c*) the eradication of disease in dairy herds. For the current financial year there may be paid out of the said Fund for the purposes aforesaid an amount, to be approved by the Minister of Finance, not exceeding £500,000.

PART IV.

This Part of the Act confers power to make all such regulations as may be considered necessary for the purpose of giving effect to the recommendations of the Dairy Industry Commission, and generally for securing the effective conduct of any of the industries over which the Executive Commission of Agriculture has any statutory or other functions. Any regulation made under this Part of the Act shall not be invalid because it deals with a matter dealt with in any Act or because of repugnancy to any Act. No person shall be liable in damages for breach of contract if such breach is occasioned by compliance with any regulations made under Part IV. All regulations must be laid before Parliament, and shall expire on the close of the last day of the session in which they are so laid unless they are expressly validated or confirmed by an Act passed during that session. While any regulation continues in force, it shall have the force of law as if it were enacted in the Act.

Noxious Weeds Amendment Act, 1934.

The object of the Act is to impose additional obligations and liabilities on occupiers of land with regard to the clearing of noxious weeds and to confer additional powers to ensure enforcement of the law in this matter. Accordingly, the amending Act imposes a continuous obligation on the occupier of land on which ragwort is growing, in districts where the plant is a noxious weed, to clear the weed from his land and to keep the land so cleared. Where, on the default of an occupier to clear his land of any noxious weed, the work of clearing is undertaken by an Inspector in the exercise of his powers under the principal Act, the cost so incurred may, on judgment for the amount being obtained against the occupier, be charged against the land, and the amount of the judgment may be enforced in the same manner as a judgment for rates may be enforced. Where the mortgagee pays any money for expenses incurred by an Inspector in clearing land under mortgage to him, the amount paid shall either be deemed to form part of the principal sum secured by the mortgage or, at the mortgagee's option, the amount so paid shall be recoverable from the mortgagor.

For the purpose of extending the principle of local control in the matter of the administration of the Noxious Weeds Act, a principle which was laid down in 1927 when Borough Councils and Town Boards were vested with power to administer the Act in their respective districts, provision is contained in section 7 of the amending Act whereby any County Council may now assume administration of the Act within the county, the procedure being by resolution of the Council, a copy of which must be forwarded to the Minister of Agriculture for gazetting. Upon the passing of the necessary resolution Inspectors under the Act may be appointed by the Council having all the powers within its district of the departmental Inspectors except the power to enforce sections 9 and 10 of the principal Act (relating to the sale of noxious seeds, undressed seeds or grain, and the cleaning of threshing-machines).

Appeals against the requirements of a Council's Inspector set out in notices served on occupiers of land for the purpose of enforcing the provisions of the Act are to be made to the Council. The powers of departmental Inspectors within any county that has assumed administration of the Act shall not be abridged or affected, but no such Inspector shall exercise any powers within the county except by direction of the Minister of Agriculture and after written notice has been given to the Council. The powers conferred by the principal Act with respect to the clearing of unoccupied Crown and Native lands shall be exercisable by the Council or its Inspectors only in such cases and upon such terms and conditions as are determined by the Minister. By section 13 of the Finance Act (No. 2), 1927, all fines recovered on informations laid by the Council's Inspector may, on application to the Minister of Finance, be paid into the general fund or account of the county subject to 5 per cent. of the amount of such fines being deducted and credited to the Ordinary Revenue Account of the Consolidated Fund.

The amending Act also authorizes any County Council which has assumed administration of the Act to levy rates for clearing noxious

weeds within the county. Rates may be levied either on the rateable-value basis or on the acreage basis in respect of all rateable property in the county. Differential rates may be levied, and for that purpose the Council may divide the county into subdivisions and must classify the lands in the several subdivisions, or in the whole county, as the case may be, into Class A, Class B, and Class C lands. Class A lands are lands for the immediate and direct benefit of which the proceeds of the rate are to be expended; Class B lands are lands for the less direct benefit of which the proceeds of the rate are to be expended; while Class C lands include all other lands. The rate is leviable only on Class A and Class B lands in such proportions as the Council may appoint. Public notice of the proportions proposed to be appointed must be given and a meeting of the Council held not less than twenty-eight days thereafter to consider all objections received. Similar notice must also be given of every classification of the lands within the county, and any person aggrieved thereby may appeal to a Magistrate against the classification on the ground that the land of the appellant or any other land has not been classified or has not been fairly classified. On the hearing of an appeal the Magistrate may cause the classification-list to be amended in such manner as he thinks reasonable, and the determination of the Magistrate shall be final and conclusive. Any classification-list may be amended by the Council but every amendment must be authenticated in the manner prescribed for a classification-list and is similarly appellable.

Other amendments of a machinery nature modify in certain respects the legal procedure to be followed in enforcing the provisions of the law in this matter.

Slaughtering and Inspection Amendment Act, 1934.

The object of this statute is to make better provision for regulating the slaughter of stock intended for export in the interests of the meat-export industry generally. By section 2 the Minister of Agriculture, acting on the recommendation of the New Zealand Meat-producers Board, may, by notice served on the licensee, fix at any time during the currency of a meat-export slaughterhouse license the maximum number of stock or the maximum number of any specified kind or class of stock that may be slaughtered in the meat-export slaughterhouse during any period specified in any such notice. Where any stock is slaughtered contrary to the terms of any notice the licensee of the meat-export slaughterhouse shall be liable to a fine of £400 for every day on which stock is slaughtered in any period after the maximum number fixed for that period has been slaughtered.

By section 3 all additions to or structural alterations of any meat-export slaughterhouse (including all cooling, freezing, and storage chambers used in connection therewith) and any increase of its freezing power must be made only with the prior approval of the Minister given on the recommendation of the Board. For the purpose of determining whether any application for approval of any proposed work should be granted the Minister and the Board are required to take into consideration—(*a*) Whether there is any economic necessity or justification for the proposed work; (*b*) the probable or possible effect of the proposed work, if authorized, on the ability of other owners of meat-export slaughterhouses to obtain regular supplies of stock sufficient

for the reasonable requirements of their business; and (*c*) all other relevant matters as the Minister or the Board thinks proper. The penalty for proceeding with any proposed work without having obtained the Minister's approval thereto is a fine not exceeding £500.

The prior approval of the Minister is also required to the erection of new premises for use as a meat-export slaughterhouse. Plans and specifications of the proposed new premises must be furnished to the Minister. After taking into consideration the same matters as are applicable to the disposal of an application for authority to make structural alterations of an existing meat-export slaughterhouse, the Minister may undertake to give his consent to the grant of a license in respect of the proposed premises if completed and a license applied therefor within twelve months from the date of his undertaking or such extended time as the Minister may allow.

By section 5 the licensee of every meat-export slaughterhouse, while the slaughterhouse is open for the slaughter of stock for export, must receive for slaughter all stock intended for export offered by a producer who has raised or fattened such stock. The stock must be slaughtered and the meat therefrom exported, if the producer so requires, on his behalf in accordance with such conditions and in consideration of the payment by the producer of such charges and allowances and the fulfilment by him of such conditions as may from time to time be approved by the Minister on the recommendation of the Meat-producers Board. The like provision may be applied by the Minister on the recommendation of the Board, made after full inquiry and discussion with the parties concerned, to require the licensee of a meat-export slaughterhouse to receive, slaughter, and handle stock intended for export on behalf of owners not being producers of stock for export. Notice of the approval by the Minister of such charges, allowances, and conditions, and of their application to owners, not being producers of stock for export, shall be given in writing to the licensee.

The amending Act further provides that the Minister may, without in any way restricting the discretionary powers conferred on him by statute, refuse his consent to the grant, renewal, or transfer of a meat-export slaughterhouse license if the licensee is convicted of an offence under the Act or fails to comply with any of the conditions approved by the Minister with regard to the receiving, slaughtering, and handling of stock for export on behalf of producers and other owners. Under the 1918 amending Act the Minister may refuse his consent to the grant, renewal, or transfer of a meat-export slaughterhouse license if he is of opinion, on such grounds as in his discretion he deems sufficient, that the business of the meat-export slaughterhouse has been carried on, or is about to be carried on, in a manner contrary to the public interest. In this connection the 1934 statute contains a declaratory provision to the effect that the buying of stock to be slaughtered for export shall be deemed to be part of the business carried on under a meat-exporter's license or of the business of a meat-export slaughterhouse for the purposes of sections 4 and 7 of the 1918 Act, and that the buying of such stock in a manner contrary to the public interest shall accordingly be deemed to be a ground for the revocation of a meat-exporter's license or for the Minister's refusal to consent to the grant, renewal, or transfer of a meat-export slaughterhouse license, as the case may be.

STOCK REMEDIES ACT, 1934.

The purpose of this statute, which comes into force on 1st June next, is to make better provision for controlling the sale of stock-remedies. For the purposes of the Act the term "stock-remedy" means any substance (including vaccines, sera, and other biological products) manufactured, advertised, or sold as a remedy for general use for the cure or prevention of disease in stock, or for the destruction or prevention of parasites of stock, or for the maintenance or improvement of the health or condition of stock, but does not include any substance which is used primarily as a stock food.

The Act provides for the establishment of a Board called the Stock Remedies Registration Board consisting of three persons to be appointed by the Governor-General as follows: (*a*) The Registrar, from among the veterinary surgeons in the service of the Department of Agriculture; (*b*) one person on the recommendation of the New Zealand Veterinary Association; and (*c*) one person on the recommendation of the Pharmacy Board of New Zealand.

Before any stock-remedy is sold it must be registered in accordance with the provisions of the Act and of regulations thereunder. Registration enures for a period of three years, and a stock-remedy may from time to time be re-registered for a similar period. Application for registration must be made by the proprietor, which term means, in the case of a stock-remedy manufactured in New Zealand, the manufacturer thereof, and, in the case of a stock-remedy manufactured overseas, the importer thereof. The application must set out the name of the stock-remedy, the trade-mark (if any) to be used in connection therewith, a description of its composition, and the preventive or remedial properties claimed in respect of the remedy. Specimen copies of every label or advertisement to be used in respect of the stock-remedy must support the application, which must be verified by the statutory declaration of the applicant. In setting out the composition of a stock-remedy the name of each ingredient, the form in which it occurs, and the proportion present in the remedy must be stated. The proportion of any ingredient present must be stated as a percentage by weight in the case of a solid stock-remedy, and as a number of grams per 100 c.c. in the case of a liquid stock-remedy. A semi-fluid remedy shall be deemed to be liquid unless recommended for use by weight. An applicant for registration may be required by the Board to furnish certificates of analysis and experimental or other evidence in support of his claims as to the efficacy of his stock-remedy. Registration may be refused if the Board is of opinion that any statement in an application for registration, or in any label or advertisement, is inaccurate, inadequate, or misleading, and cannot be conveniently omitted, altered, or amplified so as to comply with the Act. The Board may also refuse to register a stock-remedy which contains incompatible or volatile ingredients or which in its opinion is likely to be injurious to stock. The necessary regulations relating to registration and applications for registration of stock-remedies are now in the course of preparation.

To ensure that every stock-remedy sold is registered and that every registered stock-remedy is sold in compliance with the Act, the statute makes it an offence for any person — (*a*) To sell a stock-remedy before he has received a certificate of registration, in

the case of the proprietor, or a notification that the stock-remedy has been registered, in the case of any other vendor; (*b*) to sell a registered stock-remedy after the period of registration or notification received by him has expired; (*c*) to sell a registered stock-remedy in a receptacle which does not bear an approved label showing, with such other matter as the Board may approve, the name and address of the proprietor; the name of the stock-remedy; and the trade-marks, if any, under which it is sold; the net weight or volume of the product contained in the receptacle; the preventive or remedial properties claimed in respect of the remedy and directions for its use; (*d*) to sell any stock-remedy in a receptacle bearing a label containing any false or misleading particulars in relation to the contents of the receptacle; (*e*) for the proprietor or the vendor of a registered stock-remedy to use or publish any label or advertisement relating to the stock-remedy which has not been approved by the Board or which differs materially from an approved label or advertisement.

On the sale of any stock-remedy there is an implied warranty by the proprietor that the stock-remedy is reasonably fit for any purpose expressly or impliedly suggested in any label or advertisement used or published in respect of the stock-remedy. No such warranty by the Board or by the Government is to be implied by reason of registration or approval of labels or advertisements in respect of any stock-remedy.

Inspectors appointed under the Act are empowered to take samples of any stock-remedy for analysis, either on their own initiative or at the request of the buyer. In respect of any sample analysed pursuant to the Act the Analyst is required to compare the result of his analysis with the particulars in the application for registration of the stock-remedy from which the sample was taken, and where a discrepancy is found between the result of his analysis and those particulars, the Analyst must add to his certificate a statement as to whether the discrepancy would, in his opinion, be materially to the prejudice of a purchaser. Where a sample is proposed to be taken for analysis at the request of the buyer, the Inspector must satisfy himself that the receptacles containing the stock-remedy are in a sound condition, that they have been properly stored, and have not been opened or tampered with in any way. The vendor and the proprietor or their agents may be present at the taking of the sample, and, if the result of the subsequent analysis shows that the stock-remedy is not materially at variance with the particulars in the application for registration of the stock-remedy from which the sample was taken, the vendor and the proprietor shall be entitled to any reasonable expenses to which they may have been put in attending at the place at which the sample was taken.

The Board is empowered to publish in such manner as it thinks fit and without liability the results of any experiments made with any stock-remedy, or, with the approval of the Minister of Agriculture, to publish the results of any analysis of any stock-remedy or any particulars relating thereto, if in its opinion publication is desirable in the public interest or for the protection of purchasers.

Nothing in the Act limits the operation of the Poisons Act, 1908, the Dangerous Drugs Act, 1927, the Patents Act, 1908, the Patents, Designs, and Trade-marks Act, 1921–22, or any regulations thereunder.

GENERAL.

In addition to the foregoing, reference is made to two provisions of the Finance (No. 3) Act, 1934. Section 28 of the Act provides for the payment to local authorities of a subsidy from the Main Highways Revenue Fund equal to 12½ per cent. of the rates levied for the year ending 31st March, 1935, on lands used exclusively or principally for agricultural, horticultural, or pastoral purposes, such subsidy to be applied in relief of ratepayers by way of refund or rebate of a like percentage of the rates levied on such lands for the current financial year.

By section 32 of the Act the New Zealand Poultry Board is authorized to pay an additional amount not exceeding £471 in reimbursement of expenses incurred by the New Zealand Poultry Association in organizing the poultry industry before or after the commencement of the Poultry-runs Registration Act, 1933.

GARDEN LAWNS AND PLAYING-GREENS.

ESTABLISHMENT AND MAINTENANCE.

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THE New Zealand Green-keeping Research Committee(1) has been operating now for three years, and during this time much information has been secured from the experimental plots at Palmerston North, and from careful observations on garden lawns, bowling-greens, and golf-courses. In response to the many requests for advice regarding the laying-down and maintenance of lawns, this article has been prepared with a view to making current information available in a popular way.

The subject is dealt with under the following headings: (*a*) Preparation of the ground, (*b*) time to sow, (*c*) seed-mixtures, rates of seeding, and methods of sowing, (*d*) mowing and rolling, (*e*) lawn maintenance and manuring, (*f*) lawn weeds, (*g*) weed control, (*h*) grass-grub control, (*i*) subterranean grass caterpillar, and (*j*) earthworm control.

PREPARATION OF THE GROUND.

Some months prior to the sowing-down of a lawn attention should be given to the preparation of a deep yet well-consolidated seed-bed. With this end in view it is recommended that the ground should be turned over in late spring, roughly levelled, and allowed to lie fallow. The common practice of growing a crop of potatoes on an area to be sown in lawn is not recommended, as this rarely allows sufficient time for deep consolidation of the soil between the time of lifting the potatoes and the time for seeding. Deep consolidation is really only secured as a result of a natural settling, and time is an essential factor in this. Summer fallowing, where the surface, to a depth of from 2 in. to 3 in.,

(1) Figures in parentheses refer to citations given at end of this article.

is being cultivated constantly, is the best means to secure the correct consolidation in the seed-bed. The surface cultivation over this period is also effective in ridding the surface soil of weeds. The latter cultivations after levelling has been effected should be reduced in depth to ½ in. to 1 in., to allow a natural settling-down of the top 2 in. to 3 in. Each shallow cultivation will leave sufficient loose surface soil to permit this to be raked from the mounds into the hollows with a levelling-board. This implement can be made by attaching a suitable handle to a board, which should be about 4 ft. in length. The handle is attached in a manner similar to that in which a rake or hoe handle is fixed to the tool itself. The levelling-board can be dragged over the area much in the same way as a rake would be used. After each grading the soil should be firmed by rolling, following which the surface soil should again be loosened by a light raking. In most parts of New Zealand the final preparation of the ground should be completed by about the third week in March, and its accomplishment requires that a fairly fine tilth to a depth of about ½ in. should overlie a firm and well-consolidated bed—*i.e.*, one free from undulations after the final rolling.

Time to Sow.

The season for the establishment of lawns depends largely on climatic conditions. In the North Island or elsewhere, where summer droughts are experienced, sowings should be made in the autumn just so soon as one may expect the cessation of the dry weather.

Speaking generally of the North Island, this occurs in the third week in March, and experience has shown that this period is ideal for seeding. In the drier parts of the South Island where heavy frosts are experienced, sowings should be made from three to four weeks earlier than this if at all possible. In Southland, or other southern districts having a well distributed summer rainfall, sowings are best made in the late spring; but it must be stressed that on no account should spring sowings be made where the drying-out of the soil in the summer is the rule. Even artificial watering of such greens is seldom satisfactory.

It must be remembered that for the first few months after establishment the root systems of grass plants are not well developed, and the plants are unable to draw their moisture requirements from any considerable depth. Consolidation of the soil, which was mentioned previously, is rarely completed until the lawn has had the winter rains upon it, so it will be readily understood that, with a weak open turf and a loose surface soil, the moisture is quickly evaporated in the summer with a consequent weakening of the seedling plants. It is on account of the above facts that autumn sowing is generally the more satisfactory. Too late autumn sowings should be studiously avoided, as the fine lawn grasses, particularly brown-top, cannot tolerate wet cold conditions whilst in the seedling stage, and if during this period a set-back is given the establishing plants, soil fungi may be particularly harmful and considerably reduce the stand.

FIG. 1. TWO PLOTS SOWN AT THE SAME TIME.

One on left received no fertilizer, one on right manured at time of seeding with quickly acting fertilizer. Note that seed-bed was not rolled after seed was raked in.

[Photo by E. Bruce Levy.

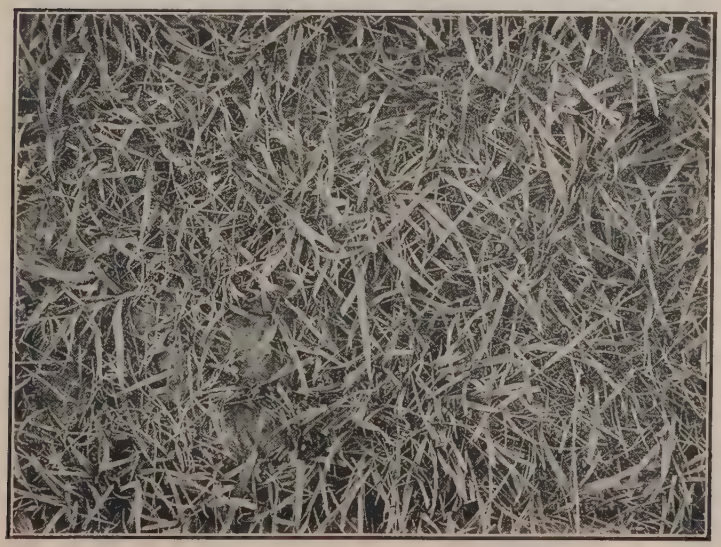

FIG. 2. WEAK OPEN TURF DUE TO INSUFFICIENT FERTILIZER.

Bare patches are open to weed invasion.

[Photo by E. Bruce Levy.

Seed-mixtures, Rates of Seeding, and Methods of Sowing.

Up to the present no more satisfactory lawn grass seed-mixture can be recommended than that of Government certified brown-top 1 part and New Zealand Chewings fescue 2 parts, sown at the rate of 1 oz. of mixture per square yard.

This seed-mixture under average New Zealand conditions produces a dense fine turf which should be able to withstand a variety of climatic conditions. Brown-top thrives best under moist conditions on a moderately fertile soil, while Chewings fescue is better able to withstand moderately dry conditions and a somewhat poorer soil. Both these grasses are fine-leaved, dense turf-formers, and very easy to mow.

In the research work at Palmerston North Chewings fescue and brown-top were sown pure and in varying combinations. Species additional to brown-top and Chewings fescue were also included in the trials, but after three years, as far as the present greens are concerned, no advantage resulted from the inclusion of these extra species, except perhaps in the early days of establishment. Both rye-grass and crested dogstail assisted in the rapid formation of turf, but ultimately to the detriment of the finer turf grasses.

The results of these sowings are indicated in Table 1.

Table 1.—Showing relative Value between Pure Sowings of Brown-top and Chewings Fescue and Mixtures of these; also Mixtures containing Species other than Brown-top and Chewings Fescue.

(Analyses (2) made on Green-keeping Research plots when less than one year old.)

——	Brown-top—Pure. (1)	Chewings Fescue—Pure. (2)	Brown-top and Chewings Fescue, 1 : 2 (3)	Brown-top, Chewings Fescue, and Crested Dogstail, 1 : 2 : 2. (4)	Brown-top, Chewings Fescue, and Rye-grass, 1 : 2 : 2. (5)
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Bare ground ..	13·0	12·0	6·0	11·0	19·0
Brown-top	56·6	1·8*	32·6	14·7	3·3
Chewings fescue ..	..	62·6	51·8	39·7	18·2
Crested dogstail ..	..	..	..	25·7†	..
Perennial rye-grass ..	..	..	..	..	53·7‡
Weeds	30·4	23·6	9·6	8·9	5·8
	100·0	100·0	100·0	100·0	100·0

* Volunteer (not sown).
† Died out under close mowing in less than two years.
‡ Tough fibrous leaves—hard to mow. Rye-grass practically died out in two years due to close mowing; turf is now very thin, and open to weed-invasion.
Note.—The figures in column 3 show less bare ground and a higher percentage ground-cover by fine lawn grasses—namely, brown-top and Chewings fescue.

To ensure a good type of brown-top being secured the purchaser should specify Government certified seed of high purity and germination. Chewings fescue is not included amongst the seeds certified by the Government, but purity and germination certificates should be examined by the purchaser, as seed of poor germination, or that which contains much weed seed impurity, cannot be expected to produce a satisfactory lawn.

FIG. 3. DENSE BROWN-TOP-CHEWINGS FESCUE TURF CORRECTLY MANURED.
[*Photo by E. A. Madden.*

FIG. 4. WEED ERADICATION WITH ARSENIC PENTOXIDE SPRAY.
Left: Weeds killed by spray. Right: Strong weed growth.
[*Photo by H. Drake.*

In the case of sowing down larger areas for sports such as football and hockey, special seed-mixtures containing the species that can stand harder wear should be used. For such sowings the following seed-mixture (in pounds to the acre) is recommended: Brown-top, 10; Chewings fescue, 20; certified perennial rye-grass, 60; crested dogs-tail, 10.

The even distribution of the seed is important, and to accomplish this it is advisable to check sow—that is, half the seed is broadcast over the whole area in one direction and the remainder is sown across at right angles to the first. Immediately after the seed has been sown a dressing of fertilizer should be applied so that it may be incorporated with the soil and be readily available to stimulate the young plants. This initial manuring, irrespective of soil types, is important to ensure quick establishment and vigorous grass growth and so reduce the competition of the weeds which also may have established (fig. 1). Quickly-acting fertilizers are essential, and a mixture of superphosphate and sulphate of ammonia in equal parts at the rate of 1 oz. per square yard is recommended.

Table 2.—Showing the Percentage of Ground not covered and that which is covered by various Species, and illustrating the beneficial Effect of applying the correct Manures at the Time of Seeding-down.

(Analyses (2) of turf made on Green-keeping Research plots approximately six months after laying down.)

	Quickly acting Nitrogenous-phosphatic Fertilizers as recommended above.	Slowly acting Nitrogenous-phosphatic Fertilizer.	No Fertilizer.
	Per Cent.	Per Cent.	Per Cent.
Bare ground	8·0	17·0	32·0
Brown-top	52·4	41·0	22·4
Chewings fescue	37·1	30·6	32·4
Weeds and clover	2·5	11·4	13·2
	100·0	100·0	100·0

The use of lime irrespective of soil type and conditions is not recommended. (See subsequent paragraph regarding manuring.)

As soon as the seeds and fertilizers have been sown the surface soil should be raked lightly to cover the seed. Deep raking for these fine seeds is unnecessary, and it usually results in having some seeds buried at too great a depth for them to germinate.

The maintaining of an even and level surface when raking the seed in is important.

Rolling after raking the seed in is not recommended, as this compacts the surface soil and makes it more difficult for seedling plants to push their way up. This is particularly true if rain falls and tends to cake the surface prior to the young plants appearing above ground. Further, if the surface soil is not smoothed by rolling some protection from wind is afforded the tiny plants, and there is less chance of the surface soil and seed being swept away by strong wind.

Mowing and Rolling of the Young Lawn.

When the grasses are well established and about 1 in. to 1½ in. in height, the young lawn may be rolled with a light roller only. Heavy rolling of young establishing greens at Palmerston North resulted in temporary damage to the young grass. The light rolling should firm the surface somewhat and flatten any small lumps of soil.

A few days after the first rolling the grass can be mown, but a point of great importance is to see that the mower blade is lifted sufficiently high to prevent cutting the young plants too closely. The turf density, which is so desirable, will be obtained more quickly from vigorous growing and strong-tillering plants, and to maintain a vigorous growth it is imperative that, particularly while young, grass must not be mown too severely or too continuously. For subsequent mowings the mower blade may be lowered still farther each time until ultimately the turf is being cut to the required closeness.

There is much controversy as to whether or not the clippings should be left on the lawn. They certainly rot down and provide plant food and they have a mulching effect on the soil in an open turf, thus preventing loss of moisture by evaporation; but against these facts one must point out that the requisite amount of plant-food is cheaply and easily applied with artificial fertilizers, and also that the smother created by mulching with clippings will ultimately cause an opening of the turf. A dense turf itself will prevent the loss of moisture by evaporation.

Should weeds such as *Poa annua*, suckling clover, and Onehunga weed be present in the turf, and they frequently are, then by removing the clippings mature weed-seeds are not permitted to fall on the turf and re-establish. This is an important factor in controlling weeds in the lawn.

Continual close mowing deprives the grass plants of their leaves, organs which are equally as essential to vigorous growth as are roots. Unless grass plants have sufficient leaf to permit carbon-fixation the plants weaken. Weak plants are unable to make strong growth, and so the turf slowly opens up. It is recommended that the lawn be spelled from close mowing occasionally, but in so doing the grass must not be allowed to grow to more than say 2 in. in height, or tillering will be inhibited and the turf will then open from this cause. After spelling the lawn, the grass should not be cut close suddenly; it is better to lower the mower blade a little each week until the turf is reduced to the required height. Spelling from close mowing will usually be more beneficial during the summer period, when the extra grass growth will protect the soil from the sun's rays and thus prevent moisture losses by evaporation.

Lawn Maintenance and Manuring.

Although the establishment period is perhaps the most critical in obtaining a good turf, the subsequent treatments govern what the ultimate turf will be.

Strong, healthy, vigorous grasses in a dense turf can usually compete more than favourably with common lawn weeds. It is neglect of the requirements of the grasses that usually results in the deterioration of the lawn, with a consequent opening of the turf and the establishment of weeds (figs. 2 and 3).

When one considers the amount of plant-food which is annually removed in the grass clippings it is realized readily that unless some effort is made to maintain the soil fertility the grasses must slowly weaken through partial starvation.

It has been found that the required standard of soil fertility can be maintained by the following treatments. During the months of April and September a mixture of superphosphate 3 parts, sulphate of ammonia 4 parts, and finely ground sulphate of iron 1 part, should be applied evenly at the rate of 1½ oz. per square yard, or approximately 4 cwt. per acre. In January and again in June a mixture of superphosphate 3 parts and nitrate of soda 4 parts should be applied at the rate of 1 oz. per square yard, which is equal to about 300 lb. per acre. The mixture recommended for the April and September dressings, by virtue of the quantity of sulphate of ammonia and sulphate of iron present, should check weed and clover growth and at the same time supply a readily available plant-food to the grasses. The January and June top-dressings are not intended to do any more than maintain a standard of fertility which should favour the growth and tillering propensities of the grasses.

The continual use of sulphate of ammonia and sulphate of iron has a marked tendency to increase soil acidity while nitrate of soda acts in the reverse manner. A degree of soil acidity is considered to be most desirable, but if acidity is permitted to increase too much harm to the turf grasses must follow. With the object of maintaining the desirable degree of soil acidity the above-mentioned manurial programme should be followed with exceptions in certain cases, which will be dealt with in subsequent paragraphs.

Superphosphate is frequently viewed with suspicion as a lawn fertilizer by many greenkeepers and gardeners on account of its tendency to induce clover and favour its growth; but it must be remembered that grasses also require phosphate if they are to thrive. Vigorous grasses are better able to compete with clover than are weak grasses, and as the clover should be controlled not at the expense of the grasses then the use of superphosphate cannot be condemned. Clover control is dealt with in the "Weed Control" section of this article.

Lime is not recommended for lawn top-dressing except under extreme circumstances, and then only after the condition of the turf grasses and that of the soil has been carefully studied. Contrary to common belief, lime will not kill moss in lawns—in fact, it is more likely to favour moss growth, especially under close-mowing conditions. As an instance of this, the reader's attention may be drawn to the moss-covered mortar (which contains a high percentage of lime) which is so frequently seen on the moist and shady side of old brick buildings.

After trials at the Green-keeping Research Area at Palmerston North with most of the quickly acting and slowly acting fertilizers procurable it has been found that the quickly acting ones have given definitely superior results for lawns and playing-greens, not only by promoting the growth of a dense healthy turf but also by inhibiting weed growth.

Both compost and sand may be used to advantage for levelling purposes, but according to the nature of the soil so should either compost or sand be used, and as a guide in this matter it should be pointed out that heavy applications of compost, which is a mixture of rotted leaf-mould (or other organic material) and loamy soil will improve the texture and moisture-retaining properties of a light soil. On the other hand sand applied to clayey soils opens them and permits surface moisture to drain away more quickly. Too much sand will cause a quick drying-out of the soil which will be detrimental to the health of the grass, particularly in dry periods.

Compost forms a rather soft resilient turf, which although not able to withstand very hard wear is quite desirable for golf-greens. Sand has the reverse action in that it makes a very hard turf more suitable for tennis and bowls. Sand and compost should be used with discretion and according to the particular requirements of the soil and turf.

An over-abundance of either top-dressing materials is not recommended, but sufficient for levelling purposes is always permissible. A warning regarding the use of unsterilized compost or sand might here be mentioned. Not infrequently has it been possible to attribute the introduction of weeds to a good, clean lawn, to the use of compost which contains weed-seeds.

Lawn Weeds(3).

The establishment of weeds in lawns frequently results from seeds which are lying dormant in the surface soil when the grass seed is sown. The majority of these dormant weed-seeds should have been eliminated by allowing them to germinate when the ground was being prepared and levelled.

Lawn-grass seed is usually free from weed-seeds, and if good pure seed is purchased the establishment of weeds in the lawn should be attributed to the presence of weed-seeds in the soil rather than to their presence as an impurity in the grass-seed. Large numbers of the early-establishing weeds are of little consequence except for their smothering effect on grass, as they do not persist long under close mowing conditions.

The great variety of lawn weeds with which the greenkeeper is concerned usually gains entrance to the lawn as the result of the turf being weakened by close continuous mowing and through inattention to the maintenance of the required standard of soil fertility.

For convenience, lawn weeds may be grouped under two general headings—(1) Flat or rosette weeds and (2) mat weeds.

The most common weeds of group 1 are catsear (*Hypochaeris radicata*), ribgrass (*Plantago lanceolata*), hawkbit (*Leontodon hispidus*), hawkweed (*Crepis capillaris*), dandelion (*Taraxacum officinale*), and field daisy (*Bellis perennis*).

Mat weeds of group 2, for convenience, may be further subdivided into (*a*) dense mat weeds and (*b*) loose mat weeds. In the former sub-group are such weeds as pearlwort (*Sagina procumbens*), slender creeping chickweed (*Cerastium vulgatum*), pennyroyal (*Mentha Pulegium*), creeping speedwell (*Veronica serpyllifolia*), moss (various species), and waxweed or shiny pennywort (*Hydrocotyle novae-zealandiae*).

Of the loose matweed group the following are the most common: Onehunga weed (*Soliva sessilis*), suckling clover (*Trifolium dubium*), white clover (*Trifolium repens*), and *Poa annua*.

Close and continuous mowing favours the growth and spread of the above weeds, which, by virtue of their somewhat prostrate growth form, escape severe defoliation such as that to which the grass is subjected.

Weed Control(3).

Although prevention of weed establishment should be the aim, it is difficult to accomplish, and so control and eradication of these undesirable plants become necessary.

It is fortunate that there are very few weeds which do not respond fairly rapidly to poisoning treatments which are both practical and economical.

Annual and perennial clovers and certain of the other weeds are easily and quickly killed by applications of sulphate of ammonia. White clover will require two applications of this chemical in either spring or autumn. Each treatment should consist of an even dressing of sulphate of ammonia at the rate of 300 lb. per acre, or alternatively the application may be made in liquid form, in which case 6 oz. of sulphate of ammonia should be dissolved in 1 gallon of water and this quantity applied with a watering-can to 6 square yards of turf. Sulphate of iron added to the sulphate of ammonia in the proportion of 1 part of the former to 3 parts of the latter substance usually assists in the eradication of clover and certain weeds, and yet minimizes the browning of the turf.

Deviation from the manurial programme recommended is permissible where white clover is competing strongly with the grasses, and instead of applying nitrate of soda for the January and June manurings the substitution of sulphate of ammonia for the nitrate of soda will assist materially in eliminating clover.

During the past seven years experiments have been conducted with arsenic pentoxide spray solution for the eradication of lawn weeds. By using this spray strictly according to instructions almost all weeds can be completely eradicated without any severe permanent injury to the turf grasses. A temporary browning-off of the lawn for from two to three weeks, however, takes place as a result of the arsenic pentoxide treatment (fig. 4).

General Instructions for Spraying with Arsenic Pentoxide.

Arsenic pentoxide, which is a deadly poison, should be kept in an air-tight tin, as it is very hygroscopic. Danger in using arsenic pentoxide results from careless handling or misuse.

The strength of the spray to be used must be determined by the condition of the turf and the weeds to be eradicated. The required quantity of arsenic pentoxide should be dissolved in a small quantity of water and diluted to the required strength. As the efficiency of arsenic pentoxide decreases rapidly when in solution, it is advisable to prepare only sufficient for use at one time.

A knapsack spray pump of the Holland's Vermorel type, fitted with a trigger release, is the most suitable kind for spraying greens.

FIG. 5.

LEFT.—CORRECT MANURING AND SPRAYING—NO INJURY TO GRASSES. RIGHT.—TURF GRASSES ALMOST KILLED BY APPLYING ARSENIC SPRAY TO TURF WHICH HAS BEEN LIBERALLY TOP-DRESSED WITH SULPHATE OF AMMONIA ONLY—NO OTHER FERTILIZER USED. [*Photo by H. Drake.*

FIG. 6.—DEAD WORMS ON SURFACE AFTER BLUESTONE TREATMENT.

Note that worms are more numerous on weak open turf on left—no manure. Plot on right treated with sulphate of ammonia and sulphate of iron, both of which are somewhat toxic to worms. [*Photo by E. A. Madden.*

A bucket type of sprayer is not recommended, as the splashing of the spray solution on to the turf will cause permanent injury to the grasses where any spilling takes place.

To ensure convenience in spraying and even distribution of the solution, the area to be sprayed should be divided into strips about 4 ft. wide, using string or binder twine for the purpose. Uneven distribution of the spray, especially the stronger solutions, must be guarded against, and care should be taken to see that the area in close proximity to the string lines does not receive a double dose.

The various strengths of the spray solution are based on the amount of arsenic pentoxide required per square yard to kill specific types of weeds when the spray is applied at the rate of 1 gallon to 20 square yards. The importance, therefore, of the even distribution of the correct strength of spray cannot be over-emphasized.

Lawns which are badly infested with weeds can be improved vastly by treating them as follows: Top-dress during January or February with a mixture of superphosphate and nitrate of soda in equal parts at the rate of 1 oz. per square yard. Substituting sulphate of ammonia for nitrate of soda for this manuring is not advised on account of the severe turf injury which may result from the combined action of the sulphate of ammonia and the arsenic pentoxide (fig. 5).

Weeds of the daisy, ribgrass, catsear type in association with mat weeds require to be treated with a 1–60 arsenic pentoxide solution during late autumn or early spring. When, however, spraying can be undertaken in late summer or early autumn, this is preferred, and in such instances a 1–80 solution will usually give satisfactory results. All spray solutions mentioned are on a weight basis—a 1–80 solution is made by dissolving 1 lb. arsenic pentoxide in 8 gallons of water.

The required strength of spray solution depends largely on the type of weed to be killed and on the condition of the turf. When the soil is moist and all plants are growing vigorously, a stronger solution will be required than when growth is slower on account of dry conditions. Spraying should not be attempted unless the foliage is thoroughly dry, otherwise the free moisture on the weeds will dilute the spray.

Certain weeds may be dealt with effectively by using very dilute spray solutions, and as a guide in this matter it may be mentioned that Onehunga weed requires a 1–180 or 1–200 solution, while suckling clover and slender chickweed, pennyroyal, and pearlwort are invariably killed by a 1–100 or 1–120 solution. These weaker solutions will have very little, if any, effect on the grass, but, on account of the weeds being killed, bare spaces in the turf are to be expected. In such an event raking the bare soil and sowing some seed thereon will soon obliterate the open spaces which were previously occupied by weeds.

Grass-grub Control(4).

In districts where grass-grub infestation is common, or when it has become necessary to resow a lawn on account of its ruination through the depredations of this pest, some preventive measures should be taken to ensure against trouble from the grub.

Cottier(4) has found that a dressing of arsenate of lead powder to the soil prior to sowing the lawn will be effective in keeping the subsequent turf free from grub for several years. The recommendation

in the article cited is that 1½ oz. of arsenate of lead powder per square yard should be incorporated with the soil so that after consolidation this quantity will be well distributed through the top inch or so.

To proof established lawns against grub attack ¾ oz. of arsenate of lead per square yard is required. The arsenate powder should be mixed with twice its volume of slightly moist fine soil and broadcast evenly while the turf is dry. Rubbing the arsenate of lead and soil mixture into the turf with the back of a rake is recommended.

The extermination of grubs already in a turf is a temporary measure only and somewhat difficult to effect. Cottier deals very fully in his article with this aspect of grub control.

The damage to turf through grass grub may be greatly reduced by maintaining a strong vigorous turf, and this can be accomplished best by correct manuring.

Subterranean Grass Caterpillar (Porina Species).

The subterranean grass caterpillar, which lives underground during the day, comes to the surface at night and feeds on the leaves of the grasses. It can cause great damage to a lawn by this surface feeding. The caterpillars vary in colour, but are commonly dark green. Their presence will be detected readily by examining small bare patches on the lawn and looking in close proximity to these patches for holes down which the caterpillars retreat during the day.

On account of the fact that the caterpillar is a surface feeder, extermination of the pest is comparatively simple. The affected area should be sprayed with a suspension of arsenate of lead made by mixing 3 lb. of this poison into 100 gallons of water. The addition of a spreader such as lime-casein at the rate of ½ lb. to ¾ lb. per 100 gallons of spray is advantageous. Sufficient spray to wet all the leaves thoroughly should be applied on a fine calm day.

Earthworms.

Under most circumstances earthworms are considered to be beneficial to the soil, but under lawn conditions it is considered that this is not so. The small mounds of earth (worm casts) which are deposited on the surface cause an unevenness of the turf. Further, in the process of mowing, these casts are rolled out flat and cause a smother which in some instances results in the death of small patches of grass.

Extermination of worms is best accomplished while the soil is moist and the worms are near the surface.

Two methods which have proved satisfactory require the use of bluestone (copper sulphate). In one case powdered bluestone is mixed with twice its weight of clean dry sand, then broadcast evenly at the rate of 1 oz. of mixture per square yard.

Sieving the mixture immediately prior to applying is recommended, as this will prevent any lumps from being deposited on the turf. As soon as possible after broadcasting the mixture the bluestone should be washed off the grass and into the soil by liberal watering. This is essential, firstly, to prevent the burning of the turf and secondly to ensure that the bluestone is washed down to the depths where the worms are most active. This will bring the worms to the surface quickly, where they will die (fig. 6).

The other method of killing worms, which is recommended where copious watering is not possible, consists of making a solution of bluestone

and applying this through a watering-can at the rate of 1 gallon per square yard. The solution which proved most effective under trials at Palmerston North was made by dissolving 1 lb. of bluestone in 100 gallons of water. Wooden or copper vessels should be used for bluestone solution.

REFERENCES.

(1) LEVY and MADDEN: First and Second Annual Reports N.Z. Greenkeeping Research. Published by N.Z. Golf Association, March, 1933, and March, 1934.
(2) —— The Point Method of Pasture Analysis. *N.Z. Journal of Agriculture*, Vol. 46, No. 5; May, 1933.
(3) —— Weeds in Lawns and Greens: Control by Chemical Sprays. *N.Z. Journal of Agriculture*, Vol. 47, No. 6; June, 1931.
(4) W. COTTIER: The Control of Grass Grub. *N.Z. Journal of Agriculture*, Vol. 49, No. 6; December, 1934.

PASTURE TOP-DRESSING IN THE AUCKLAND PROVINCE.

EXPERIMENTAL WORK BY FIELDS DIVISION, PERIOD 1928–1934.

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PASTURE top-dressing is an essential practice of intensive grassland farming in the Auckland Province, for, of the 3,900,000 acres of grassland in the province, 1,300,000 acres, forming the bulk of the pastures on ploughed land, are annually top-dressed. The practice of top-dressing started in the "eighties," following the settlement of the Middle Waikato Basin, which brought forward the local problem of grassing light soils of low natural fertility. Early Waikato top-dressing was done with a mixture of superphosphate, bonedust, and rock phosphate, but no extensive top-dressing was done until the dairy industry was properly established early in the present century.

The first cargo of basic slag arrived in New Zealand in 1892, and the fertilizer soon proved its value as a rejuvenator of old pastures. By 1900 top-dressing was becoming a recognized practice in the Waikato, and the fertilizers used were slag or a mixture of equal parts super, bonedust, and rock phosphate. Top-dressing was undertaken to rejuvenate old pastures that were running out, and it was here that basic slag, by promoting an extraordinary growth of white clover, proved to be so efficacious.

In the annual report of the Department of Agriculture for 1904 the following extract is of interest regarding the general condition of pastures in the Waikato: "One of the most, if not the most, disappointing aspects of agriculture in this district is the absence of profitable permanent pastures, except on lands of the most fertile description. At Ruakura there is no old pasture of any stocking capacity." Then, after dealing with the effect of phosphatic fertilizers in improving pastures, the report proceeds: "This would lead up to the idea that in place of the usual routine of roots, grain, and grass for a few years, and the process again

repeated, the grassland should be laid down in the best condition, and having sown the grass conserve it with judicious top-dressing."

It was at this time that the first top-dressing demonstration plots were laid down by the Department of Agriculture, plots being laid down at Waerenga in 1905 and Ruakura in 1904. These plots aroused interest in the practice of top-dressing, and clearly demonstrated the improved pasture production obtained by phosphatic top-dressing.

By 1909 top-dressing was becoming a general practice in the Waikato and South Auckland districts. Basic slag was extensively used, and the importations of slag rose from 4,000 tons in 1909 to 30,000 tons in 1914. During the war top-dressing was still largely practised, but as the war progressed fertilizer importations gradually decreased and supplies of slag were cut off. It was during the war years that superphosphate became increasingly popular as a top-dressing fertilizer.

Between 1919 and 1928 general farming practice and the results of observational top-dressing experiments confirmed the popularity of superphosphate for pasture top-dressing, although on some soils it required the addition of lime to give the best results, and it was generally on the lime-responsive soils that slag and rock phosphates still retained their popularity for top-dressing.

The Auckland Province has always been a large user of raw rock phosphates for grassland top-dressing: in the early days of top-dressing they were mixed with superphosphate, but recently there has been a tendency to use them alone. General farming experience and top-dressing experiments show that they are not as efficient as superphosphate or superphosphate and lime; they are more efficient on heavy soils than they are on light soils, and, although stimulating clovers, do not directly stimulate grass growth.

The Auckland Province contains a very large variety of soil types, and it is only recently that any systematic classification of the soils has been attempted.* As might be supposed fertilizer and lime responses have varied on different classes of land, and an attempt has been made in summarizing the results of these experiments to group very broadly the soil types with the view to later and more systematic examination of the responses on particular types of soil.

Physiography of Auckland Province.

The long, narrow North Auckland Peninsula extends in a north-westerly direction from Auckland City; it is two hundred miles long, and its greatest breadth is sixty miles. The land surface consists of scattered fragments of mountain ranges, composed mainly of greywacke and volcanic rocks, joined together by hills and rolling downs of claystone, sandstone, and limestone. Here and there, as plateaux on the downs country, occur basaltic lava flows on which are scattered low, steep-sided scoria cones; whilst in the far North and on the west coast are large areas of consolidated sand. A peculiar type of clay soil, known locally as "gumland" soils, occurs in patches throughout North Auckland. The surface soils consist of grey silts and clays and are derived from Onerahi claystones and limestones of late Cretaceous age and from Waitemata and Whangarei sandstones and claystones of Miocene age.†

* Soil Survey, Waipa County: L. I. Grange and N. H. Taylor.

† Gumland Soils of North Auckland: L. I. Grange, *New Zealand Journal of Science and Technology*, May, 1934.

On the south and east of the Lower Waikato Basin lie ranges of greywacke hills, which are finally extended as islands in the Hauraki Gulf. The Waikato River breaks through this range at Taupiri, flowing north from the Middle Waikato Basin. This lower basin of the Waikato consists of rolling downs of claystone and loosely consolidated sands and silts containing much volcanic material, and low-lying areas, being the swampy flood plains of the Waikato and its tributaries. Long sprawling spurs reach out into the flood plain, from which also low rounded hills rise like islands. Lakes are numerous on both sides of the Waikato River. These are all shallow and their surfaces are but little above the normal river level: the outlets are across the wide swampy flats of the present flood plain, and the edges of the lakes remote from the river are bordered by gently rolling hills. The lower basin of the Waikato is bounded on the north and west by basic volcanic hills, which form the chief farming district of this area.

The central volcanic plateau forms the main water-shed of the North Island. Commencing south of Lake Taupo, it stretches across the North Island from the main mountain range on the east to the high elevated marine plain on the west, and extends northwards as far as the Bay of Plenty. Relatively flat over wide areas, the plateau rises here and there into high volcanic cones and flat-topped hills and serrated ridges. Rhyolite lava flows and large masses of pumice-stone form the tableland, and the numerous volcanic cones that occur throughout its extent are built up of rhyolite, andesite, and partly also of basalt.

Lake Taupo is everywhere surrounded with volcanic rocks which form a high tableland from 2,000 ft. to 2,200 ft. above the level of the sea, and upon which numerous volcanic cones arise. The Waikato River leaves Lake Taupo at the north-east end and shapes its course north-east for a distance of twenty miles, flowing through a broad terraced valley on the boundary of the Kaingaroa Plain. After its junction with the Waiotapu River the Waikato makes a sharp turn to the west, flows through a mountainous region in a deep gorge, and emerges near Maungatautari, in the broad plain of the Middle Waikato Basin. This is a large area of flat land extending from the coastal range on the west of the Waipa to the high volcanic country in the south and east, and extending northwards to the Firth of Thames. The plain is crossed by a low range of hills which separate the plains of the Waikato and Waipa from the plains of the Piako and Waihou Rivers, which empty into the Hauraki Gulf. The land of the plains consists of low rolling hills of loosely consolidated sand and silts, containing much volcanic material, flat areas of recent water-borne pumice brought down by the Waikato River from the neighbourhood of Lake Taupo, and large peat swamps.

The south-western portion of the Auckland Province covers part of the western elevated marine plain—of limestone, sandstone, and calcareous claystone hills. Considerable areas of these have been covered by volcanic ash showers from the central volcanic plateau, and these later ash-showers have also covered portions of the low rolling hill country of the Middle Waikato Basin.

Responses to Lime, Superphosphate, and Potash.

The main top-dressing experiments laid down between 1928 and 1934 have aimed at securing data regarding the response from lime,

superphosphate, and potash on various types of soil. The plots were generally treated as follows: (1) carbonate of lime, 1 ton per acre; (2) superphosphate, 3 cwt. per acre; (3) 30 per cent. potash salts, 2 cwt. per acre. On some plots the initial dressing of lime was 25 cwt., and was not subsequently supplemented with further dressings: other plots have received further annual dressings of 5 cwt. per acre. Superphosphate and potash salts, after the initial dressings, were applied annually at the rate of 3 cwt. superphosphate and 2 cwt. of 30 per cent. potash salts per acre.

The arrangement of the plots was such as to give the following treatments and combinations of treatments:—

(1) No manure.
(2) Superphosphate.
(3) Superphosphate plus potash.
(4) Potash.
(5) Lime.
(6) Lime plus superphosphate.
(7) Lime plus superphosphate plus potash.
(8) Lime plus potash.

The above arrangement indicates the relative positions of treatments as they occurred in most of the experiments, which, for the sake of brevity are referred to as L.P.K. experiments, L being used to indicate lime, P and K being the chemical symbols for phosphorus as represented by superphosphate and potassium as represented by 30 per cent. potash respectively.

The early experiments of this series also included applications of sulphate of ammonia, applied at the rate of 1 cwt. per acre: subsequently these dressings were discontinued. The responses from sulphate of ammonia were fair to good for short periods only, but the after effect was bad—white clover was weakened and pasture growth depressed.

The responses to fertilizer treatment are given in Table 1, and the method adopted to indicate the nature of the differences has been to award points as follows: 0, no visible response; ?, doubtful; 1, slight response; 2, fair response; 3, good response; 4, very good response; 5, excellent response. In most experiments the effect of phosphates was probably less pronounced than it would have been had the pastures not received regular phosphatic dressings prior to the experiments being laid down.

The experiments have been roughly classified according to soil types (1) sandy loams, (2) loams, (3) silts, (4) clay soils.

SANDY LOAMS (RHYOLITE).

The soils on experiments numbered 1 to 21 in Table 1 are light, free-working soils and vary from white sands to reddish sandy loams. They have been formed from water-borne pumice or ash showers from the Central Plateau, and cover large areas of land in the Bay of Plenty, Central Plateau, King Country, and Middle and Lower Waikato Basins.

The soils are naturally of low fertility, being deficient in phosphoric acid and nitrogen, but since the adoption of the practice of pasture top-dressing they have proved capable of carrying first-class rye-grass-cocksfoot-white-clover pastures—superphosphate has supplied the phosphoric acid and white clover the nitrogen.

FIG. 1. LOCATION OF EXPERIMENTS.

Map of Auckland District showing location of experiments to which reference is made in Tables 1 and 2.

NOTE.—Apart from the instances specified below the numbers on the map correspond with the numbers of the experiments as given in Tables 1 and 2. Below experiment numbers precede their respective map numbers, which are given in brackets: 51 (35), 53 (16), 56 (17), 60 (7), 61 (9), 62 (3), 63 (1), 65 (28), 67 (29), 68 (30), 70 (32), 71 (32), 73 (35), 74 (35), 75 (40), 77 (42), 78 (43), 79 (41).

The pasture swards on the trials on these soils varied from first-class perennial rye-grass - cocksfoot - white-clover swards, which produce in the vicinity of 175 lb. of butterfat per acre to ones which produce only from 75 lb. to 100 lb. of butterfat per acre and on which rye-grass shared dominance with inferior grasses such as Yorkshire fog, sweet vernal, and goose grass. Table 1 shows that superphosphate alone has given a fair to excellent response, and there has been a general lack of response to lime and potash, although in a few instances small but appreciable responses have been obtained from lime. It can be said, however, that on these light soils formed of pumice and ash showers from the Central Plateau lime and potash responses so far have been negligible, and lime is not necessary to get good results from superphosphate. The superphosphate responses have varied from fair (2) to excellent (5): the variation in response is due mainly to the pasture sward, as on good pastures superphosphate gives a more marked response than on poor ones.

LOAMS (BASALT).

The soils on experiments numbered 23 to 28 in Table 1 are friable brown or red soils, known locally as "volcanic land." They occur on areas in North and South Auckland covered by basaltic lava flows and scoria cones. The soils vary in age, texture, and fertility. The soils are generally productive and closely settled, but in parts of Bay of Islands and Hobson Counties there are areas of "poor" volcanic land—viz., the "ironstone" soils in parts of Bay of Islands County have a rubbly surface of limonite pebbles beneath which is a thin layer of poor soil: the soil permits a too rapid percolation of rain water and has too high an iron content for the successful growth of pasture plants.* There are also in Hobson County areas of light "volcanic" land which are excessively dry. With these exceptions the volcanic soils are of good natural fertility, their chief drawback being a tendency to dry out badly in the summer. Pastures consist of rye-grass, cocksfoot, and white clover, with a fair amount of paspalum in parts of North Auckland. Rib-grass is a common weed, and subterranean clover occurs in many pastures.

In addition to the six L.P.K. trials shown in Table 1, there were eight lime and potash plots placed on phosphated grassland—in four of these lime gave a response and in five there was a slight or questionable response from potash. In four of the L.P.K. trials lime alone gave a definite response, whilst in two the response was doubtful. In the six L.P.K. trials, potash gave either no response or the response was doubtful.

SILTS.

The soils in experiments 31 to 33 in Table 1 are grey gumland silts—acid soils of low fertility which have developed under conditions favouring intense leaching. These soils are popularly known as "pipeclay" soils, and have been extensively dug over for kauri-gum. The three experiments show that there is a response to lime, and that a mixture of superphosphate and lime is more efficient than superphosphate alone: they also show a slight response to potash.

In developing these poor gumland soils the process is to fill the holes left by gum-diggers, drain, and plough: the ploughed land requires at

* Ironstone Soils of North Auckland: L. I. Grange, *New Zealand Journal of Science and Technology*, July, 1934.

least a six months' fallow, and to secure a satisfactory seed-bed the land is best twice ploughed. Before sowing grass, ground limestone should be applied at the rate of 1 ton per acre and the grass mixture used should consist of perennial rye, paspalum, and white clover, and the grass-seed should be sown along with from 3 cwt. to 4 cwt. of superphosphate or basic slag. Thereafter the pastures require annual dressings of 3 cwt. of superphosphate or slag. A moist, well-consolidated seed-bed is essential for a good "take" of white clover, and successful pasture establishment depends as much on careful cultivation as on the fertilizers and lime used.

CLAYS.

Experiments 35 to 50 in Table 1 are on recent alluvial clay soils, and responses to fertilizers vary considerably. They are all on land of high fertility carrying either rye-grass, cocksfoot, white clover pastures or paspalum, rye-grass, and white clover. The soils in Hauraki Plains show no responses to lime, superphosphate, or potash: the land is of high fertility and it is possible for slight increases to occur which are not visible to the eye. Top-dressing is not practised on these rich alluvial soils, and it is obvious that fertilizers do not give any marked increases in growth. On other clay soils there is a fairly general response to lime and superphosphate, and a doubtful or slight response to potash.

RESPONSES TO SUPERPHOSPHATE, SUPERPHOSPHATE AND LIME, SLAG, AND ROCK PHOSPHATES.

The results of another series of trials are shown in Table 2: these trials have aimed at securing data regarding the comparative efficiency of superphosphate, superphosphate and lime, slag, superphosphate and slag, and rock phosphates on different types of soil. The phosphates or mixtures of phosphates were applied at the rate of 3 cwt. per acre and the lime generally at 1 ton per acre. The method of awarding points to measure differences, outlined above, has again been used. Superphosphate and basic slag appear to be generally equally efficient as top-dressing fertilizers: in some trials, superphosphate and lime is superior to superphosphate, and the superior results secured by the use of superphosphate-slag mixture over superphosphate alone or slag alone are interesting. In most trials the rock phosphates were inferior to superphosphate or slag.

CONCLUSIONS.

The results of the top-dressing trials detailed in Tables 1 and 2 confirm general farm practice. Superphosphate is generally the cheapest and most efficient phosphate for pasture top-dressing, but on some soils lime is necessary to enable the best results to be obtained from superphosphate. Slag is also quite efficient, but is not superior to superphosphate or superphosphate and lime. Rock phosphates are generally inferior to superphosphate or slag. Potash responses are not frequent, and, where responses are secured, they are generally slight.

ACKNOWLEDGMENTS.

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Table 1.—Responses to Fertilizers.

Experiment No.*	County.	Soil Type.	Responses to Fertilizers: 0, No Response; ?, Doubtful; 1, Slight; 2, Fair; 3, Good; 4, Very Good; 5, Excellent Response.					
			Lime.	Super.	Potash.	Lime-super.	Super-potash.	Lime-Super-Potash.
1	Whakatane ..	Sandy loam†	0	3	0	3	3	3
2	Tauranga ..	Sandy loam†	0	3	0	3	3	3
3	Tauranga ..	Sandy loam†	0	3	?	3	3	3
4	Tauranga ..	Sandy loam†	0	3	0	3	3	3
5	Tauranga ..	Sandy loam†	2	3	0	4	3	4
6	Tauranga ..	Sandy loam†	1	3	0	4	3	4
7	Tauranga ..	Sandy loam†	1	2	0	2	2	2
8	Tauranga ..	Sandy loam†	0	3	?	3	3	3
9	Tauranga ..	Sandy loam†	?	2	0	3	2	2
10	Otorohanga ..	Sandy loam†	0	2	0	2	2	2
11	Otorohanga ..	Sandy loam†	0	2	0	3	2	3
12	Otorohanga ..	Sandy loam†	?	2	0	2	2	2
13	Rotorua ..	Sandy loam†	0	5	?	5	5	5
14	Rotorua ..	Sandy loam†	−2	2	?	3	3	3
15	Rotorua ..	Sandy loam†	1	2	?	2	3	3
16	Taupo ..	Sandy loam†	1	3	?	3	3	3
17	Taupo ..	Sandy loam†	1	3	?	3	3	3
18	Matamata ..	Sandy loam†	−?	3	0	3	3	3
19	Matamata ..	Sandy loam†	−1	3	?	3	4	4
20	Matamata ..	Sandy loam†	1	3	−1	3	3	3
21	Matamata ..	Sandy loam†	1	4	?	4	5	5
22	Rotorua ..	Loam‡ ..	1	3	1	3	3	3
23	Bay of Islands	Loam§ ..	2	2	0	4	3	4
24	Whangarei ..	Loam§ ..	1	2	?	3	3	4
25	Whangarei ..	Loam§ ..	2	2	?	3	1	3
26	Manukau ..	Loam§ ..	?	1	0	1	1	1
27	Manukau ..	Loam§ ..	3	2	?	4	2	4
28	Franklin ..	Loam§ ..	?	?	..	1	?	1
29	Ohura ..	Loam ..	1	3	1	3	3	3
30	Ohura ..	Loam ..	1	3	0	3	3	3
31	Whangarei ..	Silt‖ ..	1	2	1	3	2	4
32	Whangarei ..	Silt‖ ..	0	2	1	4	3	4
33	Waitemata ..	Silt‖ ..	1	1	?	2	3	5
34	Whangarei ..	Clay ..	4	1	?	5	1	5
35	Hobson ..	Clay ..	0	3	0	3	3	3
36	Hobson ..	Clay ..	2	1	1	3	3	3
37	Hobson ..	Clay ..	1	2	1	3	3	3
38	Manukau ..	Clay ..	3	?	?	3	?	3
39	Manukau ..	Clay ..	1	1	0	2	1	2
40	Franklin ..	Clay ..	3	1	..	4	1	4
41	Hauraki Plains	Clay ..	0	0	0	0	0	0
42	Hauraki Plains	Clay ..	0	0	0	0	0	0
43	Hauraki Plains	Clay ..	0	0	0	0	0	0
44	Hauraki Plains	Clay ..	0	0	0	0	0	0
45	Hauraki Plains	Clay ..	0	0	0	0	0	0
46	Hauraki Plains	Clay ..	0	0	0	0	0	0
47	Hauraki Plains	Clay ..	0	0	0	0	0	0
48	Hauraki Plains	Clay ..	0	0	0	0	0	0
49	Hauraki Plains	Clay ..	0	0	0	0	0	0
50	Waitomo ..	Clay ..	1	2	1	2	2	2

* Experiments: (1) 16/1/124, F. Reynolds, Edgecumbe; (2) 16/1/139, L. P. Jensen, Omanawa; (3) 16/1/121, J. W. Mutton, Te Puke; (4) 16/1/140, Ridder Bros., Tauranga; (5) 16/1/176, J. Courtney, Te Puke; (6) 16/1/162, Wilson Bros., Lower Kaimai; (7) 16/1/201, D. Donovan, Te Puke; (8) 16/1/141, C. O. Bayley, Omokoroa; (9) 16/1/120, W. Bennett, Te Puke; (10) 16/1/173, Walters and Sons, Otorohanga; (11) 16/1/172, H. A. Lurman, Otorohanga; (12) 16/1/170, H. Gall, Otorohanga; (13) 16/1/156, Ngakuru Block 1, Rotorua; (14) 16/1/191, R. H. Hill, Atiamuri; (15) 16/1/210, R. Dawson, Rotorua; (16) 16/1/188, T. N. Forrest, Reporoa; (17) 16/1/190, G. G. Seccombe, Reporoa; (18) 16/1/207, H. L. Pearson, Tokoroa; (19) 16/1/203, R. Thompson, Tokoroa; (20) 16/1/209, C. G. Penwarden, Putaruru; (21) 16/1/189, A. R. Vosper, Putaruru; (22) 16/1/206, R. Copeland-Smith, Rotorua; (23) 16/1/160, A. Laird, Awarua; (24) 16/1/180, H. W. Ellis, Maungatapere; (25) 16/1/184, F. Walker, Maungakaramea; (26) 16/1/178, E. C. Montgomery, Mangere; (27) 16/1/177, R. Bell, East Tamaki; (28) 16/1/198, R. F. Wilkinson, Pukekohe; (29) 16/1/112, J. McAvady, Matiere; (30) 16/1/143, F. Pleasants, Matiere; (31) 16/1/181, Kokich Bros., Kokopu; (32) 16/1/94, Puwera Experimental Area, Puwera; (33) 16/1/147, R. Matheson, Waimauku; (34) 16/1/183, P. Hoban, Whareora; (35) 16/1/98, Northern Wairoa Experimental Farm, Dargaville; (36) 16/1/185, P. Hill, Hoanga; (37) 16/1/132, Glen Robson, Ruawai; (38) 16/1/169, J. H. Faulconbridge, Manurewa; (39) 16/1/167, F. D. Clayton, Manurewa; (40) 16/1/195, Pearson Bros., Patumahoe; (41) 16/1/103, P. E. Hale, Kopuarahi; (42) 16/1/104, D. McCauley, Pipiroa; (43) 16/1/105, Ganley and Galvin, Pipiroa; (44) 16/1/133, W. J. Nash, Orongo; (45) 16/1/134, A. B. Corbett, Orongo; (46) 16/1/135, A. Peate, Orongo; (47) 16/1/136, A. H. Rodgers, Orongo; (48) 16/1/137, L. Durman, Kerepeehi; (49) 16/1/138, J. Spence, Ngatea; (50) 16/1/171, E. Tolme, Aria.

† From rhyolite. ‡ Surface layer of Rotomahana mud. § From basalt. ‖ Grey gumland silt.

Table 2.—Responses to Fertilizers.

Experiment No.*	County.	Soil Type.	Response to Fertilizers: o, No Response; ?, Doubtful; 1, Slight; 2, Fair; 3, Good; 4, Very Good; 5, Excellent Response.					
			Super.	Super-lime.	Slag.	Super-slag.	Nauru.	North African Phosphate.
51	Hobson ..	Sand ..	2	3	3	..	..	1
52	Taupo ..	Sandy loam†	3	..	3	4	..	..
53	Taupo ..	Sandy loam†	3	..	2	4	..	..
54	Taupo ..	Sandy loam†	3	..	3	3	..	..
55	Taupo ..	Sandy loam†	3	..	2	3	..	..
56	Taupo ..	Sandy loam†	3	..	3	3	..	..
57	Taupo ..	Sandy loam†	3	..	3	2	..	..
58	Rotorua ..	Sandy loam†	4	..	..	..	..	2
59	Rotorua ..	Sandy loam†	2	3	3	..	1	1
60	Tauranga ..	Sandy loam†	2	3	2	..	..	2
61	Tauranga ..	Sandy loam†	2	3	3	..	..	2
62	Tauranga ..	Sandy loam†	3	3	3	..	..	2
63	Whakatane ..	Sandy loam†	3	3	3	..	..	2
64	Taumarunui ..	Sandy loam†	3	3	2	..	..	1
65	Franklin ..	Loam‡ ..	1	2	2	..	1	1
66	Franklin ..	Loam‡ ..	4	4	2	..	..	2
67	Ohura ..	Loam ..	3	3	2	..	..	2
68	Ohura ..	Loam ..	3	3	3	..	..	2
69	Waitomo ..	Loam ..	3	4	2	..	1	..
70	Whangarei ..	Clay ..	2	3	3	4	..	1
71	Whangarei ..	Clay ..	2	3	2	3	..	1
72	Hokianga ..	Clay ..	3	..	4	..	1	..
73	Hobson ..	Clay ..	3	3	3	..	..	1
74	Hobson ..	Clay ..	3	3	3	..	..	1
75	Franklin ..	Clay ..	2	4	3	..	1	2
76	Raglan ..	Clay ..	3	4	3	..	..	3
77	Hauraki Plains	Clay ..	0	0	0	..	..	..
78	Hauraki Plains	Clay ..	0	0	0	..	..	..
79	Hauraki Plains	Clay ..	0	0	0	..	..	..
80	Hauraki Plains	Clay ..	0	0	0	..	..	..

* Experiments: (51) 16/1/98, Northern Wairoa Experimental Farm, Dargaville; (52) 16/1/112, A. J. Gillanders, Reporoa; (53) 16/1/111, T. N. Forrest, Reporoa; (54) 16/1/114, E. Forster, Reporoa; (55) 16/1/113, W. W. Meikle, Reporoa; (56) 16/1/115, G. G. Seccombe, Reporoa; (57) 16/1/110, H. A. Alexander, Reporoa; (58) 16/1/83, W. Gill, Guthrie; (59) 16/1/215, Smyth Bros., Ngongotaha; (60) 16/1/201, D. Donovan, Te Puke; (61) 16/1/120, W. Bennett, Te Puke; (62) 16/1/121, J. W. Mutton, Te Puke; (63) 16/1/124, F. Reynolds, Edgecumbe; (64) 16/1/14, C. Osborne, Makokomiko; (65) 16/1/198, R. Wilkinson, Pukekohe; (66) 16/1/81, I. A. Motion, Pukekohe; (67) 16/1/142, J. McAvady, Matiere; (68) 16/1/143, F. Pleasants, Matiere; (69) 16/1/15, C. Harrison, Te Kumi; (70) 16/1/95, Puwera Experimental Farm, Whangarei; (71) 16/1/94, Puwera Experimental Farm, Whangarei; (72) 16/1/69, E. Underwood, Oue; (73) 16/1/96, Northern Wairoa Demonstration Farm, Dargaville; (74) 16/1/97, Northern Wairoa Demonstration Farm, Dargaville; (75) 16/1/195, Pearson Bros., Patumahoe; (76) 16/1/75, G. A. Eyre, Pepepe; (77) 16/1/104, D. McCauley, Pipiroa; (78) 16/1/105, Ganley and Galvin, Pipiroa; (79) 16/1/103, F. E. Hale, Kopuarahi; (80) 16/1/109, J. A. Mangan, Pipiroa.

† From rhyolite.

‡ From basalt.

Tung Oil.—The planting-out of further areas in tung-oil trees in the North Auckland District has been steadily proceeding during the year. It is estimated that the total area now planted is between 3,000 acres and 4,000 acres. As mentioned in my previous report it is not possible to give any indication as to the success or otherwise of this venture until the trees reach a bearing stage and nuts are available for analysis and testing. The importance of adequate shelter for the satisfactory growth of the plants is a feature that is now being more realized by the companies operating.—*Report, Director, Horticulture Division.*

GRADING AND MARKING OF BUTTER AND CHEESE BY OVERSEAS COUNTRIES.

G. M. VALENTINE, Assistant Director, Dairy Division, Department of Agriculture, Wellington.

A CLOSER knowledge of the systems of grading dairy-produce which are in use in other exporting countries leaves one with a feeling that the methods followed in New Zealand reach a standard which is simple and efficient and gives very little room for complaint from those who have to handle our butter and cheese at the consuming end.

The following facts, which were noted in the various countries visited, all have some feature which has no doubt been adopted to suit local conditions.

BUTTER.

The two systems generally in vogue are the one followed in our own country, and that which is done by calls at irregular intervals for samples to be sent in for examination. The latter has the disadvantage that when the examination shows that the butter is of high quality it is assumed that the whole output until the next examination is of the same standard. When the quality is poor the matter is followed up. There is also a system which is a combination of both —viz., that in use in the Irish Free State.

Northern Ireland.—The export trade from Northern Ireland is comparatively small, and lasts for only a short season during the summer months. The butter is graded by surprise calls to the factory for two rolls of butter which are examined in Belfast by judges chosen from a panel of merchants who grade it for flavour and body. Only three grades are employed. Three successive scores of the highest grade entitle the factory to use a Government mark, and three failures to reach that standard result in the withdrawal of the right to use the mark.

There is also an unofficial grading of butter at the Central Railway-station, Belfast, on the arrival of the butter on two days of each week. This grading is controlled by a committee of merchants and creamery managers, and the grading is carried out, on request of the consignee, by two merchants and the secretary of the committee, one box from each churning being examined. Butter graded " Premium " is stamped with a special mark.

Irish Free State.—Butter-grading was established at the Cork Butter Exchange in 1769 on a voluntary basis, and in 1903 a system of surprise inspections was organized by the State. In 1924, the Dairy Produce Act brought in a system of dairy instruction and grading and general supervision of the industry which in most respects is on similar lines to our own, but also retains the surprise inspections.

A distinction is made between creamery butter and factory butter. The former is butter made in a creamery, and factory butter is farm butter which has been blended in a factory. Out of a maximum of 60 points for flavour and 30 points for texture, creamery butter must score 54 and 24, and factory butter 50 and 20 points to qualify for export.

Under the surprise inspection scheme two boxes of butter are selected and sealed in the factories by the inspectors, and these must be despatched within two days to the butter station in Dublin. It may be of interest to mention that the boxes known in the trade as the "pyramid" are made of half-inch North European pine, are wider at the top than at the bottom, and have both top and bottom square in shape.

Before grading, the butter is held for ten to fourteen days at room temperature. Then, the brands being covered, it is examined by three inspectors, each working independently. The scores are averaged and if there is a big discrepancy in the scores allotted by the individual inspectors a further examination is made in company.

The points scored are flavour 60 points; texture 30 points; colour 5; and finish 5. The butter is also weighed and tested for water, salt, yeasts, moulds, bacteria, &c., and is then returned to the factory for examination by the manager. All the results are published, but the names of only the highest scoring factories are given.

As the high duty practically prohibits the importation of butter into the Irish Free State, and the winter make is only about 4 per cent. of the summer make, estimates of the winter requirements are made in October each year, and the export ceases after a given date.

Examinations of the butter held over for winter consumption are thus made possible, and it is claimed that a pH value of 6·7 has given the best results in these storage trials. As no starter is used in the manufacture of the butter, and all the cream is skimmed from whole milk, there is no developed acidity, and the graders are very definite that Irish butter made with starter would not keep as well as that made without it.

The wash water of each factory is examined once each year, the samples being taken by the inspectors.

Denmark.—Butter is graded in Copenhagen at the State Agricultural Experimental Laboratory each Monday morning. Voluntary grading was started as early as 1889, but was made statutory and compulsory in 1911.

The grading is carried out by six merchants and three managers, divided into three groups working in separate rooms, and presided over by an instructor, the Irish system of scoring independently and then averaging being followed. Fifteen points is the maximum and cover chiefly flavour and body, though uneven colour or gritty salting is penalized. One cask on the day of my visit was scored 14 points by the instructor in charge but was reduced to 12·9 points on the average. This was a nice full-flavoured but mild butter, without that metallic character which is characteristic of some high-acid Continental butters.

The factory is notified by telegram when butter is to be sent in, and must at once forward one cask which is already packed. It is then held for approximately fourteen days, the time which would normally elapse before use. The casks are covered, as also are the paper slip showing the date of manufacture, and the cypher mark of the factory, which is placed on the butter at each end of the cask. The cypher marks are constantly changed, and the slips are issued by a Government institution which keeps a record of the numbers

and can thus establish the identity of the factory using them. They are so thin that it is practically impossible to remove them from the butter without tearing them. This butter is bought from the factories at the current price. The date of manufacture is placed on the two Lur-branded staves, which are sold to the dairy companies by the Ministry, and which are placed opposite each other in every cask. The object of placing the date of manufacture on the containers is to enforce a weekly clearance of the butter in the freshest possible condition.

Should the butter not be up to the "Lur" standard another cask is called for immediately, and the factory is advised to consult the instructor for the district. If this is not done, and the fault is not remedied, the right to use the Lur brand is withdrawn, and the police are ordered to remove and withhold all Lur-branded packing and control slips, &c., at the dairy. As butter which does not bear the Lur brand cannot be exported, the local market is the only one open to a factory without authority to use the Lur brand.

The curd content of the butter is under 1 per cent., and the salt about 1 per cent.; and an argument which took place between the merchant representatives and the instructor during the luncheon following the grading referred to the salt content: the merchants held that more salt could be used with advantage for the North of England, and the instructor argued that it would spoil the flavour of the butter.

As a means of providing an indication of the quality of the butter made by each factory, the Danish system falls far short of the New Zealand practice of examining every churning, as it is assumed under the Danish system that all butter made between one scoring and the next will be of even standard—the number of examinations of the butter of each factory is said to average about three yearly except in those cases where the quality is poor. On the other hand, it is probable that the system on which the factories are run, involving a whole-milk supply, a restricted area from which the milk is drawn, and a comparatively small output, makes for more even results from day to day in comparison with New Zealand conditions. There is also the fact that generally the butter does not undergo a long storage period.

In addition to the grading, there is a voluntary "warehouse test" which has been introduced during recent years, and which is availed of by 75 per cent. of all dairies. The exporters take a sample of about 3 lb. of butter of each dairy and hold it for fourteen days. At the end of this time it is examined by the dairy representatives and, where possible, by an instructor. The results of the examination, which are sent to the State Agricultural Experimental Laboratory, indicate the dairies where the quality is not being maintained.

In addition to the grading, a system of inspection of dairy-produce is carried out by eleven inspectors controlled by the Chief Inspector of the Government control service, and this inspection seems to take the place of grading in European dairying countries other than Denmark. It is not a guarantee of quality so much as one of purity, and does not cover every churning as does the New Zealand system.

Check weighings are carried out and samples for analysis are taken at any point, at the dairies, in warehouses, on rail, and at the ports, which may be convenient to the inspectors. Moreover, the Government control service is familiar with the output and despatch days of the dairies and knows literally to the hour when the dairy's butter should arrive at the railhead, &c.

In addition to checking the composition of the butter, samples of cream, buttermilk, and skim milk, numbering some thousands yearly, are tested to check the temperature of pasteurization, which must be at least 176° F.

Holland.—There is no official grading of butter in Holland, although a national brand is in use, as it is in practically all European exporting countries.

Private grading for the purpose of distribution to the various markets and subsequent payment to the factories is carried out by the co-operative marketing associations, such as the Frico in Leeuwarden, which controls the outputs of some forty factories situated in Friesland. Flavour and body are noted, and, owing to the difficulty of making a good body in Holland—more importance is attached to body, perhaps, than to flavour—it is the practice in that country to leave the butter in the cask during summer weather.

In addition to the Government instructors, the Frico has three instructors working among their factories, and the butter is sent in as soon as it is made and is stored at the depot in Leeuwarden and shipped to Britain twice weekly.

The National Co-operative Society at Amsterdam markets the butter and milk powder for some eighty-odd factories outside of Friesland, and has three collecting and shipping centres.

The butter control stations in Holland were established for the purpose of guaranteeing the purity of the butter made in that country, and the Government mark placed in each cask gives a guarantee of purity—it is not an indication of quality.

There are nine control stations and a letter is allotted to each. The paper slips issued to each station include this letter and also cypher marks indicating the factory to which they are issued by the control station.

Although the stations are voluntary organizations they have been supervised since 1904 by the Government dairy inspection service, and the statutes or amendments to statutes under which they operate require ministerial sanction before they can be adopted. About 90 per cent. of the butter made in 1927 was controlled. The control was established in the first instance to prevent the adulteration of the butter with margarine, but fat-content and water-content are now taken into consideration, and members "must not have ready for supply butter containing more than 15½ per cent. of water," though a margin up to 16 per cent. is allowed.

Reliance was at first placed on chemical analysis for determining the addition of foreign fat, but it was found that by this method butter which was pure was sometimes condemned, owing to the variation in the composition of the butter made at different factories and at the different seasons of the year. The practice now followed is to take samples of butter and cream from each factory at least twice monthly at irregular intervals. The cream

is churned at the control station, and the analysis of the cream and of the butter made from it is taken as a basis of comparison to determine the purity of the butter made by the factory.

For the purpose for which the control stations were established, the organization is a thorough one, falling short only in the point that every churning is not examined, but its first purpose was to deal with a phase of the industry which has never developed in New Zealand—namely, adulteration of butter with foreign fats.

Britain. — Owing to the large imports of butter and cheese to Britain the amount produced within the country is generally overlooked, but the output of one butter-factory visited was at the time of the visit about 10 tons daily, and the turnover amounted to 1,000 boxes daily, including blends and pats of imported butters.

It seems obvious that the milk marketing boards will be forced to undertake the manufacture of butter in order to handle their surplus milk, and arrangements have been made already by the Ministry of Agriculture for a national-mark scheme for creamery butter, to be put into operation during the present year in England and Wales. Details of the scheme are not yet available, but they include provision of satisfactory plant and equipment, inspection of the hygienic condition of same, and production of butter of a standard quality, defined as follows: Clean in flavour, firm and neither greasy nor oily, even in colour, bright and clean in appearance, and showing no free moisture. Butter which complies with this standard will be classed "selected" and can bear the national mark which is in general use for home-grown produce of the highest quality. The national mark is a map of England and Wales with a design representing the Union Jack, &c.

CHEESE.

Britain.—In 1933 a grading scheme for Cheshire cheese of both farm and factory make was introduced in England and Wales: under the scheme the farm cheese is graded on the farms by the official grader of the Cheshire Cheese Federation, which controls the scheme under ministerial supervision. One cheese of each day's make is examined, the day's output is then stamped with the grade and date of examination, and this entitles the owner to affix the national mark and the grade which may be "selected" or "extra selected."

Factory cheese is graded in the factory by an official of the Ministry, one cheese from each vat being examined: the stamping and marking is carried out in the same manner as in the case of farm cheese. Only full-cream cheese is graded. The premises of the manufacturer are subject to inspection by the grader.

The influence of the grading is indicated by the prices obtained for the cheese, as graded lines are generally quoted at several shillings above ungraded lines in the cheese fairs. The suggestion has been made from time to time that the grading should be extended to cheddar cheese, and with the manufacturing now largely in the hands of the milk boards it is probable that such a step will be taken.

Irish Free State.—The importation of cheese into the Irish Free State is prohibited. The total manufacture is in the vicinity of

1,000 tons per year, and the consumption about three-quarters of a pound per head yearly, so that it is a very minor branch of the dairy industry.

Denmark.—The cheese industry in Denmark is not an important one when compared with butter, and the manufacture was not subject to control until 1921. In 1933 the total output of cheese was 31,258 metric tons, of which 67 per cent. was consumed at home. The principal variety is Gouda, which is made in four different classes from full-cream down to 10 per cent. of fat in the dry matter. The water content is specified and ranges from 50 per cent. in full-cream cheese to 60 per cent. in the cheese containing 20 per cent. fat in the water-free substances.

Immediately on being made all hard cheese must be marked at the dairy with an indication of the minimum fat content in the dry matter, and the control number of the dairy. This is done by affixing casein discs to the rind during pressing. The discs for the purpose are supplied by the control department, and are perforated to make them adhere to the cheese, and also to make it almost impossible to remove them without destroying them. Thus 30 per cent. plus would indicate that the fat in the water-free substances is more than 30 per cent. They must also be marked with the calendar week of the year.

The work of the control department is to check up the composition of the cheese for comparison with the attached disk, and as there are nine different types of cheeses, each with a different fat and water content, the necessity for this check will be readily understood. Of the 1933 output, only 37 per cent. was full-cream cheese. As in the case of butter, the control is in the hands of the State. It does not involve a grading for quality.

Holland.—In Holland the output of cheese is much greater than that of butter, the figures for 1933, which were supplied by the Department of Agriculture at The Hague, being 120,000 tons of the former and 80,000 tons of the latter. As in Denmark, a large percentage of the cheese is made from partly skimmed milk, and the control was established for the purpose of guaranteeing the classification as marked on the cheese. The two principal varieties are Gouda, which takes its name from the town of Gouda in South Holland, round which is the chief cheese-making area for that variety, and Edam, which originated in the district of that name further north, and to the south of the Zuyder Zee. Both varieties were originally made on the farms, but are now made in factories also, and in several grades of fat-content.

It is claimed that the full-cream farm-made Gouda cheese is the highest quality made in Holland, and in 1906 the first cheese control station was established in South Holland. In 1913 a ministerial decree was issued adopting the existing mark as a Government mark for whole-milk cheese.

A second control station followed later. These stations are owned by the farmers but are supervised by the Government, and membership is voluntary. In 1927 5,602 farms were under the control of these two stations, which employed seventy-two officials. The whole of the expenses of these stations is found by the farmers, but the

instruction work is supervised by the Government, and the checking of the fat-content of the cheese is done by the control stations, which also issue the casein disks which indicate the class of cheese, the cypher marks showing the control station from which it was issued, and from the records the person to whom it was issued and the date of manufacture can be traced. Members must submit to strict supervision by the control officials, and must undertake to make their cheese twice daily immediately milking is finished, and to remove no fat from the milk. Between the hours of manufacture no cream or skim milk is allowed on the farm, and a separator may not be used. Complete records of manufacture must be kept.

"Volvet" or full-cream cheese is guaranteed to contain 45 per cent. of fat in the water-free substances, but 46 per cent. is actually required at the time of making, and, if made only once daily, 48 per cent. of fat in the water-free substances is required. The actual average is nearly 50 per cent.

With the advent of the factory system the manufacture of part-skimmed cheese extended, due it is said to the fact that the percentage of fat in the milk in some districts, and in the mixed milk supplied to some factories, was higher than the milk of some single herds, thus making it a business proposition to standardize down to the legal minimum of the class of cheese being made.

By ministerial decree in 1918 Government marks for this class of cheese were issued for cheese containing 40+, 30+, and 20+ per cent. fat in water-free substances. Cheese containing less than 20 per cent. of fat does not carry a Government mark and must be more than 32 lb. in weight. For full-cream cheese a circular mark, printed in blue, is used, and for part-skimmed a hexagonal mark, printed in black. In each case 2 per cent. of fat in excess of that shown by the mark is required, and there are now three control stations, in addition to the two established by the farm cheesemakers which deal with full-cream cheese only.

As with the Gouda variety, the Edam cheese was originally made on the farms, but might be either full-cream or part-skimmed. The practice was to set the night's milk in the cheese-vats and hand-skim it next morning before mixing the warm morning's milk with it. Since separators became available the factory practice has been to skim some of the milk, and very little full-cream Edam cheese is now made. It is claimed that the quality of the cheese made in this way is not as good as when the milk was hand-skimmed, though factory practice is to make it twice daily.

The fat content of the Edam cheese is controlled, and either variety cannot be marked full-cream even when made from whole milk if the fat-content in the water-free substances is not equal to the standard.

Only cheese bearing the Government mark may be exported, and of the total make of 126,000 metric tons in 1927 only 5 per cent. was outside of the control.

During the year ended 31st March, 1934, cultures sufficient to inoculate 91,080 lb. of lucerne-seed were forwarded from the Plant Research Station to farmers throughout the Dominion, an increase of more than 21,000 lb. over last season.

APHIDES AFFECTING CULTIVATED PLANTS.

(1) THE CARROT, PARSNIP, AND WILLOW APHID.

W. COTTIER, Entomology Section, Plant Research Station, Palmerston North.

THE aphid, *Cavariella aegopodii*, at certain times of the season causes serious damage to carrots and parsnips and less obvious damage to willows (*Salix* spp.).

In January or February it will be noticed frequently that carrot-tops become wilted and tend to lie prone on the ground, and if an examination be made it will often be found that the cause of this is the action of aphides or plant-lice which are present in innumerable thousands on the leaves where their white cast skins can be seen littering the foliage. In cases of severe attack an offensive smell is commonly given off, and the vegetable-tops will be sticky with "honeydew" exuded by the insects. Parsnips are attacked in the same way, the aphides living mostly on the undersides of the leaves.

Aphides derive their food by piercing the plant tissues with their mouth parts and subsequently sucking up the sap, so that it can be understood easily why the presence of a large number of them causes wilting.

APPEARANCE OF THE PEST.

There are two adult forms commonly met with in the field—viz., the winged and wingless females. The appearance of the winged form is as follows: The head and antennæ are black; the eyes are black and the thorax very dusky green; the thorax bears two pairs of wings, the front pair being large and the other comparatively small; the abdomen is green traversed by dusky bands, and there are also dark patches on the sides of the abdomen. This winged female serves as the principal means of distribution of the pest.

The wingless form has the head yellowish-green with the eyes black or very dark red; the antennæ are lighter in colour than is the head; the body is yellowish-green, often with a darker green mottling. This form presents a somewhat flattened appearance as if it were closely appressed to the leaf.

The young are similar in appearance to the wingless female.

DISTRIBUTION AND HOSTS.

This insect is not a native of New Zealand, but has been introduced accidentally. It is recorded also from other parts of the world—*e.g.*, England and Egypt.

The host plants known so far in New Zealand, are carrot, parsnip, willows of various types, and the native *Aciphylla* sp. Hosts besides these in other parts of the world are *Aegopodium podagraria* (gout weed) and *Foeniculum vulgare* (fennel).

LIFE HISTORY.

The life-cycle of this aphid is interesting and instructive from the point of view of control. In the autumn there are developed in the aphid-colonies on carrot and parsnip special winged forms which

fly to adjacent willows. On the willows there are produced from these individuals wingless egg-laying females. Winged males appear at the same time and mate with the egg-laying females, which subsequently lay their eggs in the axils of the buds. The eggs are shining black, and there may be several in each bud axil on an infested willow twig. Such is Nature's method of ensuring the survival of the species during the cold weather and until suitable food is again available in the spring. The eggs remain dormant throughout the winter, and in the following spring they hatch at the same time as the willow buds burst, so that a succulent food-supply is right at hand. After feeding and breeding on the willow foliage for a period the colonies produce winged forms which migrate to such plants as carrots, parsnips, and *Aciphylla*. The writer has found this migration going on in November, but it is not usually until after Christmas that the insects have bred to sufficient numbers to cause serious damage. On the carrots, &c., the aphides produce living young and pass through several generations until the autumn when the winged "return migrants," as they are called, return to the willows to recommence the cycle. It is interesting to note that egg-laying females and the males are produced in the autumn only, and that all other reproduction is asexual—*i.e.*, the females give birth to living young without fertilization by the males.

Control.

In this connection it is important to remember that the presence of infested willows will always be liable to cause trouble in the carrot crop. Of course, the best method of prevention is to avoid growing such crops in the vicinity of these willows, or, if this is impossible, then grow carrots as far away as possible from the source of infestation.

If the area is not too large, infested plants may be sprayed with black leaf 40, 1 part to 800 parts of water, with the addition of soap at the rate of from 2 lb. to 3 lb. per 100 gallons of spray.

ESTIMATED AREAS UNDER WHEAT, OATS, BARLEY, AND POTATOES, SEASON 1934–35.

Following the usual practice, cards were recently posted to grain-growers and to potato-growers throughout the Dominion for the purpose of ascertaining the areas which they had sown or planted, or intended to sow or plant, in wheat, oats, barley, and potatoes this season. Estimates have now been made, based on the replies received. The figures appear below, and results in connection with the 1933–34 collection of statistics are shown for purposes of comparison.

	Wheat.	Oats.	Barley.	Potatoes.
Areas, 1934–35 (estimated) :—	Acres.	Acres.	Acres.	Acres.
North Island	7,000	23,900	2,800	5,100
South Island	221,600	288,900	19,800	15,200
Dominion	228,600	312,800	22,600	20,300
Areas, Dominion, 1933–34 ..	294,992	364,729	29,607	25,028

—*Abstract of Statistics.*

SOME NOTES ON PLANT DISEASES.

MADE DURING A VISIT TO GREAT BRITAIN AND EUROPE.

J. C. NEILL, Field Mycologist, Mycological Laboratory, Plant Research Station, Palmerston North.

DRY-ROT OF SWEDES.

THIS disease appears to be present wherever swedes are grown whether for fodder or seed. Because of my late arrival in Great Britain, and of the partial failure of the crops owing to the drought, I was able to inspect only nine crops of seeding swedes. Of these, seven were definitely infected and the other two were in a condition that made thorough examination impossible.

Of fodder crops, I inspected in October nine crops in Northern England and sixteen crops in Scotland, and in every case the disease was present. Generally it was confined to a few isolated patches, but in three crops it was well distributed, one showing from 80 per cent. to 90 per cent. of infected bulbs. This latter crop had been surface-manured with fresh byre dung after sowing.

No direct measures are taken to combat the disease, but a good practical measure of control is obtained through the long rotation cropping system. At least four years elapse between two swede crops on any field, the bulbs in most districts being pulled, carted, and fed to housed stock. This cropping land is seldom used at any stage of the rotation for grazing. Thus there is little opportunity for fragments of partially rotted bulbs to carry over the disease, the only infections arising directly from infected seed. Since modern bulk commercial swede-seed seldom contains more than a very few infected individual seeds, and since spread from such a "primary" centre is slow and delayed until late in the season, little loss of crop results.

With seeding swedes the congested condition of the seedling bed conduces to early spread of infection, and, since this is a specialist business on small or moderate sized holdings, the crop interval is apt to be curtailed.

Since the visit of the Mycologist to the United Kingdom in 1929, the principal seedsmen have become fully alive to the necessity of reducing infection to a minimum in seed destined for the New Zealand market.

MOTTLED-HEART OF SWEDES.

A disease of swedes very similar to if not identical with that known as "mottled-heart" in New Zealand appears to be increasing in incidence in Great Britain. In Scotland it is particularly prevalent on the west coast, being known in Ayrshire as "Roan." Little attention has as yet been paid to the disease in fodder crops, but growers of table swedes are becoming alarmed at its increasing prevalence, since it seriously reduces the market value of their produce.

Inquiries in Holland, Germany, and Denmark showed that the disease is common in all three countries, but opinions varied as to whether its incidence was increasing. In Canada what is apparently the same condition, there known as "brown-heart," had, on the evidence of Dr. Gussow, Dominion Botanist, seriously threatened the

Canadian export of table swedes to the United States. Experiments there showed that 80 per cent. control could be obtained by the addition of boron compounds to the soil.

Club-root.

Only two of the twenty-five crops of swedes visited showed the presence of club-root, and in neither was the infection severe. The long rotation, absence of grazing-stock, and liberal treatment of the land probably accounts for this. In the opinion of farmers the disease is one of market and kitchen gardens rather than of farms. Liberal liming, good farming, and a long rotation are regarded as the best means of control. Resistant varieties are little used: the "Bruce" yellow Aberdeen turnip, though the subject of much propaganda and widely tried, has not met with favour in the districts visited.

The rapidly increasing use of marrow-stemmed kale (chou-moellier) as a substitute for swedes and turnips is attributed in part to its power of resistance to club-root and dry-rot.

Diseases of Cereals.

Wheat.—Little or no disease was seen in the few wheat crops inspected. On the evidence of seed-testing stations and merchants, it appears that stinking-smut is still fairly common, especially in England, where modern methods of dust treatment for the seed are only very slowly being adopted. Research workers are becoming more interested in the soil-borne disease classed generally under the head of "foot-rots." Apart from the obvious losses these cause in seedling mortality, it is believed that attacks causing a partial crippling of the root system, not detectable on casual inspection, may have a considerable effect in lowering the general yield. Work on this difficult group of diseases has so far been directed to finding a suitable experimental technique as a preliminary to the evolution of methods of control.

Oats.—The use of organic mercury dusts for the treatment of seed-oats has become a generally adopted practice, especially in Scotland and Northern Ireland. This has followed on the remarkable results obtained in 1931 and 1932 in the control of leaf-stripe disease and consequent large increases in yields. The dry spring weather of 1933 and 1934 was unfavourable to development of the disease, and consequently the dust treatments showed only slight advantages when compared with seed not so treated. Nevertheless, all farmers visited were of the opinion that the organic-dust treatment is a valuable practical improvement on the older methods because of its simplicity of application, the insurance it affords against possible heavy losses caused by disease, and the reduced rate of sowing made possible by its use.

Barley.—As with oats, the noteworthy advance in method for disease control in barley is the increasing use of organic mercury dust seed-treatment. It is found that, besides controlling covered smut, these dusts are effective against stripe disease and minimize seedling mortality when unfavourable weather follows sowing.

Diseases of Potatoes.

Late Blight.—Little progress has been made in the evolution of new methods for the control of this disease. Bordeaux and Burgundy mixtures are still regarded as the best spray control, and no commercially valuable variety has yet been discovered which is immune to the disease.

Virus Diseases.—The degeneration troubles and crop losses due to this group of diseases are the subject of much research work in the United Kingdom, Holland, Germany, and Denmark. In Holland only has practical application of existing knowledge resulted in their virtual elimination, the Dutch growers having been forced into stringent co-operative measures by the great importance of their export trade in seed potatoes.

It appears probable that the economic control of the potato industry established recently in Great Britain will be extended to cover measures similar to those in force in Holland.

Wart Disease.—Particular attention was paid to this disease in view of the possibility of its introduction into the Dominion and the fact that our main commercial varieties are classed as highly susceptible to the disease. In general, it appears that wart disease is a trouble of the kitchen garden rather than of the field, and that only exceptionally does it cause serious loss of crop even in infected soil. So much importance is, however, placed upon its occurrence that movement of potatoes is severely restricted from areas in the neighbourhood of a reported occurrence. In one case in Fifeshire a malicious farm servant deliberately introduced the disease into his cottage garden and then reported its occurrence to the authorities. As a consequence, no seed potatoes were allowed export from land within an area two miles in radius from the cottage, comprising some of the best seed-producing farms in Scotland, thus causing the farmers a loss of many thousands of pounds.

Instant measures should, of course, be taken to stamp out any discovered outbreak of the disease in the Dominion, but, even if these fail, it should not be regarded as a major calamity.

General.

Other diseases which are receiving particular attention in Great Britain are the virus and root diseases of strawberries and raspberries, virus diseases of tomato, damping-off diseases of seedlings, and turf diseases of playing-greens. An interesting fact, communicated to me by Mrs. N. L. Alcock, of Edinburgh, is the discovery of *Sclerotinia trifoliorum* sclerotia on the seed of British-grown white clover—heretofore regarded as only occurring in New Zealand and hence as conclusive evidence when present of the origin of any sample of white-clover seed. Very fine work is being done at the Forest Products Research Laboratory at Princes Risborough on the fungous rots and stains of timbers and methods for their control.

A striking modern development in plant pathology is the attention being paid by the large chemical manufacturers to research work in disease control. Several of them, notably the Imperial Chemical Industries in England and the I. G. (Bayer) corporation in Germany, employ large staffs, admirably equipped, of trained mycologists and entomologists for the sole purpose of determining whether any of the new compounds evolved by their chemical research departments has value for disease or pest control. It is likely that new materials and methods will, in the future, originate largely from this source.

ERADICATION OF GORSE AND THE UTILIZATION OF GORSE-INFESTED LANDS.

T. W. LONSDALE, Fields Division, Department of Agriculture, Wanganui.

ON mountain pastures of the northern counties of England, gorse (*Ulex europeus*) is not unfavourably regarded, and as sheep continuously graze these pastures, gorse provides a considerable amount of sheep food, is looked upon as an almost indispensable plant, and under the system of continuous grazing does not become a menace, as in many parts of this country.

Gorse was brought to New Zealand by the early settlers not for the purpose of providing fodder, but to grow as hedges for subdivision of land and also for the shelter on the then wind-swept plains of Canterbury. From there, through human and animal agency, it has spread to almost all parts of New Zealand, and also to adjacent and outlying islands. It is not confined to inferior lands or any particular habitat, but, owing to our congenial climate being favourable for the propagation of plant-life, gorse is rapidly encroaching on valuable pasture and arable lands, and to-day we are not interested about its erstwhile valuable properties, but confronted with the problem of its control, if not of its ultimate extermination.

ERADICATION ON ARABLE LAND.

There is no valid reason for allowing gorse to occupy arable land, from which its eradication is easily and economically effected by the aid of mechanical appliances, prominent amongst which is the plough. The effectiveness of this implement depends on the vigour of the plants and the stage of growth attained.

Presuming that gorse is dominant, the area which it is desired to clear may be fired, preferably during late summer. The seat of ignition should be to leeward; this allows the fire to travel "up wind," or, in general phrase, "against the wind," thus effectively clearing all vegetation, leaving only charred branches which, if not too big to plough under, need no further attention. In the event, however, of the plants being vigorous and of considerable age prior to burning the area will require cleaning up before the plough can be operated. A tractor and heavy roller will break down the burnt branches, and, furthermore, smash the charred material to such an extent that most of it can be ploughed under, leaving only the rough and thicker sticks to be gathered and carted off the land prior to ploughing.

Accelerated by fire and autumn rains, the accumulated seed of many crops rapidly germinates, so that when the plough is brought into play the product of a succession of years is buried and for all time destroyed.

There remain, however, millions of seeds which escape the fire. These will germinate from time to time as they are brought to the surface in the process of cultivation, but need not cause any concern; the same process that stimulated germination will hasten extirpation.

SUBSEQUENT UTILIZATION OF THE LAND.

A variety of crops may follow, and whatever seed is planted immediately the manurial requirements are already partly and liberally

provided by the nitrogen fixation of the growing gorse and the residual ash of the burnt plant; consequently, phosphates only need be applied. If the soil is adapted to wheatgrowing no more suitable crop can be grown. Any gorse that grows with the wheat does not affect the cereal or incommode reaping operations, and, as the stubbles are afterwards grazed over by sheep, the young gorse provides useful and nutritious forage; at the same time the grazed plant receives a set-back and is killed when the land is next ploughed.

Rape or any other plant of forage can be successfully grown on the first or successive ploughing, and after a course of cropping the land can be laid down safely in grass, and, if given reasonable attention with regard to mowing, grazing, and manuring, the erstwhile gorse-infested land will for all time remain clean.

Control where Ploughing is Impossible.

It is on those areas where mechanical aid cannot be brought into operation that we are confronted with the greater problems of eradication and subsequent economical upkeep and utilization of gorse-lands.

In considering these, it is advisable to divide the lands into two types—(1) That which can be maintained as useful and payable pasture; (2) poor hills and gullies.

From time to time proprietary preparations have been on the market, and many statements have been circulated extolling the effectiveness and most remarkable achievements of the various preparations. No chemical treatment of gorse which has been shown to be economically effective has so far come before the public.

On hill lands which can be classified as potentially useful grassland it is essential first to cut the gorse; on no account should growing gorse be burnt on this type of land. Such burning leads to millions of seeds germinating immediately after the ashes cool, and the result is a dense mass of young gorse which can neither be cut nor burned again. Cutting should be done during late spring or early summer, and the heavier the gorse the more effective will be the clearance. When cutting is completed no further action is necessary until March, when, weather conditions being suitable, the gorse should be burnt; and, as previously mentioned, it is advisable to ignite the mass so that the fire travels against the wind. By so doing the fire does not pass too rapidly over the area, and, consequently, burning is accomplished more effectively. Frequently it is said that cutting may be done at any time of year and the result will be the same, but this is incorrect. If gorse is cut during the winter or late autumn, the interval between cutting and burning is too long, consequently the spines fall from the branches, burning is not effective, and growth starts immediately from the original stumps.

Sowing the Burn.

No time should elapse between burning and sowing grass-seed—and, in connection with the latter operation, let me say that seeding and manuring should be liberal in order to establish quickly a good sole of grass which can be stocked early, that is, within a reasonable time after sowing the seed.

Varieties of grass sown will, of course, be determined to some extent by the class of soil. However, in all cases it is desirable to include in the mixture *Danthonia pilosa*, brown-top, subterranean clover, and, wherever climatic conditions are suitable, paspalum should be included.

It may be asked why are these plants specifically mentioned. However thorough cutting and burning and seeding be, and no matter how carefully managed with regard to stocking the resultant pasture, gorse persists, and, in the event of a thick crop of gorse seedlings growing and being neglected by stock, it may become advisable to close the area, allow the herbage to ripen, and again burn off; and the pasture plants specified tolerate such burning-off relatively well.

SUBDIVISION OF AREAS.

While it may not be possible always to fence gorse lands economically, there is no doubt that subdividing large areas facilitates subsequent management and control of herbage. Gorse cannot thrive when heavily stocked, and heavy stocking can be carried on only where fences are strong and paddocks of reasonable area.

GULLIES AND STEEP HILLS.

In many instances gorse is in full possession of gullies and steep hillsides, and, while portions of these are of no value, there is a very large area which might be utilized profitably in growing trees for timber. Pines and eucalypts in such situations ultimately "choke" gorse, and, if the trees are safeguarded against destruction by fire, gorse-infested gullies and hillsides will in several decades become valuable forest lands.

THE LLOYD GEORGE RASPBERRY.

THE Orchard Instructor, Gisborne, has supplied the following note:—

The Lloyd George variety of raspberry appears to have excellent prospects of proving successful when grown in the warmer districts in New Zealand, where few, if any, other varieties succeed. In the winter of 1932 small canes were planted at Gisborne in moderately moist, porous loam alongside of other raspberry bushes which were originally secured from a commercial garden in Greytown (variety unknown). During the 1932-33 season the Lloyd George variety made extremely vigorous growth and produced several good sprays of fruit. In the following season the bushes carried a heavy crop, whereas the bushes of the Greytown variety carried a very light crop and made poor growth. The fruit of the Lloyd George variety was very large, of good flavour, and commenced to ripen in mid-November. Some of the heaviest pickings were made about the end of November. The crop continued until about the end of January. The fruit of the other variety did not commence to ripen until 24th December. The growth of the Lloyd George is inclined to be straggly, but the canes remain reasonably erect to a height of about 2 ft. 6 in., thus enabling the rambling portion to be removed during the winter pruning without sacrificing good canes. The following quotations from recent overseas publications are interesting:—

Advisory Leaflet No. 180, "The Cultivation of Raspberries," Ministry of Agriculture and Fisheries, London, May, 1933. In this publication Lloyd George is mentioned first of what are reported to be the four leading commercial varieties, and it is stated:—

"Lloyd George is one of the most extensively grown and heavy croppers; the berries are easily plugged, are firm, and travel well. It is one of the best varieties for canning. The picking season extends over a long period; the first ripening berries are ready to be gathered as early as those of any other, and earlier than most varieties. In some districts a loss of vigour occurs after the fourth year; where this prevails it is advisable to select canes from the most vigorous plants and make a new plantation."

Bulletin No. 625, "Raspberry Growing in New York State," New York State Agriculture Experimental Station, Geneva, New York, April, 1933. In this publication it is stated,—

"Lloyd George is too soft, turns dark, and is of low growth and sprawling habit under most conditions, although its fruit is very large, handsome, and of excellent quality for the table and for jam."

SEED-WHEAT CERTIFICATION.

CERTIFIED CROPS.

UNDER the Government scheme for the certification of seed wheat, the following additional growers have seed for sale from crops which have passed both field and grain inspections. (Previous lists, to which purchasers are referred, were published in this *Journal* in February and March, 1935) :—

Variety.	Grower.	Acreage.
Cross 7	*Canterbury Seed Co., Leeston	6
Dreadnought 5/27	*R. Dick, Weston, via Oamaru	25
	*G. Stevenson, Weston, via Oamaru	14
Hunter's II ..	J. G. Abbot, Coutt's Island, Kaiapoi	7
	W. H. King, Rosewill, Timaru	30
	*Mrs. E. G. Paterson, Otaio, South Canterbury ..	50
	F. L. D. Young, " Brockfields," Winchester ..	7
	D. J. Ireland, Goodwood, Otago	18
Solid Straw Tuscan	Canterbury Seed Co., Leeston	29
	*N. Cox, 230 Wairarapa Road, Christchurch ..	5
	*H. Curragh, Weedons	7
	D. Findlay, Christchurch–Greendale, R.M.D. ..	23
	H. W. J. Goodwin, Wincopes Road, Halswell ..	11
	Estate C. Smith, R.M.D., Rangiora–Springbank ..	30
	Mrs. F. Woffindin, Pleasant Point, via Timaru ..	8
	G. Newlands, Kauru Hill	30
	W. S. Stevenson, Incholme, R.M.D., Oamaru ..	22

* Passed subject to machine dressing.

—*Fields Division.*

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 7th March to 21st March, 1935, include the following of agricultural interest :—

No. 71714 : Solution of ingredients toxic to weeds ; E. Marsden. No. 72266 : Apparatus for spraying weed-killing solution ; E. Hope. No. 72538 : Stock-drenching instrument ; Ject-in Ltd. No. 73038 : Sodium chlorate (*Cognate with* No. 71714 above). No. 71599 : Hay-stacker ; W. Alexander. No. 71621 : Hopple-protector ; W. Patching. No. 73328 : Drenching-gun ; D. R. Dowling. No. 73413 : Preserving fruit ; A. Gerner-Rasmussen. No. 73424 : Milk-supporting platform ; T. Shiels.

Copies of full specifications and drawings in respect of any of the above may be obtained from the Commissioner of Patents, Wellington, price 1s., prepaid.

There has been an alteration in the dates of the Fifth Science Congress, which is to be held at Dunedin, not on 28th May to 31st May, as was stated in this *Journal* in March, but on 27th May to 30th May, inclusive.

Despite the fact that a great deal of clearing has been carried out, ragwort has become so widespread that it might appear that no real headway has been made in its eradication or proper control. It must be borne in mind, however, that approximately 500 tons of sodium chlorate went into consumption during the season, and this, with other methods of destruction, must account for no small measure of success in clearing. Many individual farms have been cleared and kept clear of ragwort, but, on the other hand, there are many that are probably worse than they were a year ago. Special efforts have been made to keep the already clean districts clear of ragwort.—*Report, Director of Live-stock Division.*

SEASONAL NOTES.

THE FARM.

Influence of Management and its relation to Planning.

THE extent to which management affects profits in farming seems but imperfectly to be realized. Hence some consideration of the matter may direct attention usefully to the scope for improvement in farm efficiency and returns. Examination of the position on farms which naturally are similar, but which human endeavour has made very different farms financially, discloses generally that inefficient management is due to waste in respect to either outlay or labour.

Farm surveys provide striking evidence that there is a great difference in the efficiency of farm labour; for instance, a recent survey disclosed that under relatively uniform conditions of soil and climate the production of butterfat per unit of male adult labour, unaided by subsidiary family labour, ranged from 3,338 lb. to 10,480 lb. While the butterfat-production per unit of labour is far from a full measure of the absolute efficiency of management, such a range as specified above is surely significant. Efficiency in farm labour is correlated closely with planning ahead by an experienced mind so that there is proper organization of effort. Farming-work, to be fully successful, must be planned so that there is provision not only for carrying out every detail of an operation, but also for carrying it out at exactly the proper season. Time and again very disappointing results in important farm measures may be attributed to neglect in respect to only one of the chain of facts which beget full success. For instance, considerable wise outlay and effort in respect to the establishment of permanent pastures is at times wasted because of sowing at an unsuitable date, and again much labour in cropping may be made largely ineffective by too late attention to such operations as weeding, thinning, or spraying.

These illustrations exemplify well the fact that waste of labour may be due not so much to idle hours as to lack of a well-planned programme of work, and help to explain those cases, known to most of us, of farmers who work hard for long hours without ever achieving satisfactory success. The remedy in such cases is additional mental labour to make the physical labour properly effective. Apart from the indirect waste of labour due to doing work at unsuitable times, or with poor material or equipment, there often occurs direct waste of labour due also usually to lack of proper planning ahead so as to avoid idle hours especially in the case of paid hands. It is advisable to have other work available as soon as one task is completed or when bad weather necessitates cessation of certain work. Labour is likely to be wasted, and this possibly when the time factor is particularly important, as in such tasks as seed-sowing, hay-making, and other harvesting, if advantage is not taken of slack seasons to attend to such matters as drainage and repairing of implements. Probably not enough attention is given to the avoidance of peaks in labour-requirements by planning ahead so as to obtain the greatest possible distribution of work; sharp rises and falls in the amount of work calling for current attention are commonly associated with hurried effort lacking care and thoroughness, or with unduly heavy casual labour costs on the one hand or with idle hours of permanent labour on the other hand. On many farms some planning would avoid considerable wastage of time in running about.

Many of these aspects of labour utilization may seem so self-evident as to be not worth mentioning, but in practice they are ignored frequently, and this partly explains the great variations in the productivity of labour.

Poor management in regard to outlay takes several forms. One of the most serious of these may be described as parsimony or false economy in the guise of economy. One of the commonest instances of this is the purchase, because of the relative low cost, of seeds poor in respect to either their germination capacity or the inherited characteristics of the resultant crops.

A kindred instance is the lack of suitable equipment or the use of poor equipment which prevents the full exploitation of the labour available. This is one of the greatest causes of inadequate provision of feed for stock during the critical late summer and winter-early-spring periods. It is certain, for instance, that the area devoted to ensilage would be substantially greater were labour-saving measures, including important yet inexpensive ones, more freely employed. Similarly, many farmers are handicapped in the production of special crops by lack of implements. Certainly it is advisable to be cautious in rectifying such positions because of the possibility, as distinct from the probability, of hampering other phases of the farm work by unduly heavy investment in equipment, but it may be said definitely that excessive caution in this direction has been exercised in the past.

Another very common form of mismanagement in respect to outlay arises indirectly from wasteful utilization of feed, whether it be purchased or grown on the farm. This occurs seriously at times when the feed which productive farm animals receive is much less than is needed to meet their joint maintenance and production requirements. This may be illustrated readily by considering the requirements of a good dairy cow of about 1,000 lb. weight. Annually such a cow requires about 10 tons of grass or its equivalent for maintenance and about 1 ton of grass or its equivalent in addition for each 30 lb. of butterfat produced. A consumption of 15 tons of grass annually gives enough nutriment, after maintenance requirements are satisfied, to allow of the production of 150 lb. of butterfat—*i.e.*, 10 lb. of butterfat for each ton of grass. Similarly, a consumption of 23 tons of grass allows of the production of 390 lb. of butterfat—*i.e.*, 17 lb. of butterfat for each ton of grass or its equivalent. The differences in the productivity of feed according to differences in its utilization, as disclosed in this comparison, may seem somewhat extreme, but they appear at times to be paralleled in practice. The position may be stated in concrete form as follows: Using cows of good productive capacity, 345 tons of grass or its equivalent could be fed at the rate of 15 tons annually to each of twenty-three cows, which from such a feed-supply could produce a total of 3,450 lb. of butterfat, or it could be fed at the rate of 23 tons to each of 15 cows which could produce 5,850 lb. of butterfat. The difference in production is due primarily to the fact that in the former system of feeding 80 tons more than in the latter are used solely for maintenances and thereby are "wasted" relative to butterfat-production. Commonly in other branches of farming, among which pig-keeping and lamb-rearing may well be cited, feed is similarly wasted in that an unduly small proportion of it is available for production, because, conversely, an unduly heavy proportion is required for maintenance. Much the greatest and an easily corrected cause of an unsatisfactory relation between feed required for maintenance and feed required for production is failure to plan ahead the provision of feed to meet the requirements of stock from one season to another. Incidentally it is of practical importance to keep in mind that at times the efficiency of management cannot be measured in terms of feed units consumed. For instance, rapid feeding from birth to slaughter as a rule is more economical in feed units consumed than feeding which involves a period of slow growth or of store condition in animals. As an example of this the late Professor Wood, of Cambridge University, calculated that 10 cwt. of baby beef could be produced from a consumption of 830 lb. of dry matter for every hundredweight of baby

beef, whereas, in the production of 12 cwt. of beef in the form of a 2½-year-old bullock, 1,220 lb. of dry matter would be required for each hundredweight of beef. It cannot be decided from such figures whether or not the more intensive type of feeding is the more economical until the cost of the dry matter required in each type is known. In New Zealand the cost of dry matter in grass, roots, and dairy by-products is usually much less than that of dry matter in meals and grains, and this at times justifies departures from the feeding practice which, while most economical in terms of feed units, is not most economical under present circumstances in terms of costs. As a current instance of this, pigs for slaughter early in the following dairy season as baconers profitably have been carried through the winter largely on cheap feed, such as roots and grass, and then finished off cheaply with concentrates available at a suitable stage in the diluted form of dairy by-products. It is likely that at times during the inter the weights of the animals did not reflect satisfactorily the feed being consumed, but nevertheless the practice as a whole proved sound financially.

From the above considerations it would appear that a keynote of sound management is planning ahead as a means of avoiding waste, direct and indirect, in respect to both labour and material.

Planning of Feed Provision.

It is seasonable to plan the coming year's programme of special feed provisions—possibly later it may prove advisable to make modifications in respect to minor matters, but it should be possible to adhere to the main features of any plan which in the meantime is likely to serve usefully as the basis of decisions about such jobs as cultivation work and the location of fences and of ensilage pits and trenches, to which attention often well may be devoted in the winter.

Usefully, in general, the planning of the provision of special feed could be based upon the fact that normally the supplementary feed available for periods of scant direct supplies from grassland could be increased substantially with great profit. Behind the planning, and especially when there is much dependence upon ensilage, should be the aim to create not merely seasonal reserves, but also annual reserves of feed; there is no certainty at all that during next summer the pastures will yield enough surplus growth to give reasonably safe supplies of silage and hay, and safety in regard to supplies of the cheapest possible feed is a maxim of efficient stabilized farming. Hence, if in the recent unfavourable season reserves of feed were depleted to an unusual extent, then cropping to strengthen the position suitably should be planned. It is of seasonal interest that the mangel (the Dominion acreage of which is much less than is warranted by the outstanding value of the crop) often gives the largest and most profitable yields when grown after grass ploughed in May or June. Such ploughing allows enough time for the thorough decay of the buried sod and results in a richer, more kindly soil due partly to the incorporation of the rotted sod with the remainder of the soil. As an alternative to ploughing at this stage, skim ploughing or disking of the sod in the spring, followed by deep ploughing, may be expected to give good results. Similar preparatory cultivation for lucerne, carrots, and potatoes, when these crops are to follow pasture, is, as a rule, profitable. In the preparation for these crops heed should be given to the fact that a buried sod, if not broken up, means not only a soil less rich in plant-food material, but one in danger of drying out in a dry spell because the unbroken sod checks the rise of soil-water from below it: this is likely to be of vital importance in the drier districts in which the supply of moisture often is the factor which most limits yields.

A common weakness in the provision of special feed is the giving of attention only to the stock of major importance on the farm and the neglect

of the needs of types of stock which, though of less, are nevertheless of considerable, importance, and which would respond very profitably to proper feeding. For instance, on mixed farms in the South Island the needs of dairy stock seem often to be forgotten, and similarly on dairy-farms throughout the Dominion the potential profit in feeding special crops properly to pigs frequently is overlooked.

On the mixed farms in the South Island much could be achieved in profitably meeting the needs of dairy stock, simply by extending the arable cropping undertaken for the feeding of sheep. In pig-rearing good results have been obtained, according to circumstances, from the use of pastures and lucerne for grazing, and of barley, maize, peas, pumpkins, chou moellier, and all the main farm roots according to seasonal requirements. Limited experience suggests satisfactory results from the emergency use by pigs of green cereals for grazing, but in this the relation between costs and returns calls for close consideration.

General Cropping.

The remarks in last month's notes relative to general cropping work are applicable widely to current operations. In districts in which arable cropping is prominent, no opportunity should be missed at this stage of proceeding with cultivation work, and sometimes it is of assistance to act upon the fact that lea land may at times be worked with safety when adjoining similar land which has been under the plough recently is too wet.

Autumn Utilization of Crops.

Often lucerne suffers much as a result of being grazed in late autumn and early winter, a practice which should be avoided as a rule, even though there is a growth of a few inches in height on a lucerne area at this stage. Actually, such a growth is far from wasted even if it is not consumed by stock: it often checks development of weed seedlings by depriving them of light, whereas if it were removed the lucerne stand usually would be weakened to some extent because some of its energy would be employed in renewing the herbage. Such weakening often is specially undesirable as the maximum strength is needed for success in the spring competition with weeds. Should a lucerne area already be infested badly with grass and clover, it may be good practice to utilize it chiefly as a pasture from which it may be possible to obtain as many as three cuts a year.

Because of the unfavourable past season in many parts, the coming winter and spring probably will be characterized by hard treatment of many stock, and on this account it is well to note that young developing stock, such as calves and hoggets, are likely to suffer severely and also permanently unless they receive good treatment. This fact calls for attention not only during winter itself, but also prior to winter, when the stock should be trained to eat such feeds as silage and hay, while they are still in good condition, and before they are called upon to live almost wholly on such unfamiliar feeds, a timely gradual introduction to which obviates the set-back at times suffered by live-stock as a result of sudden changes in feed. Hoggets should be given the best possible treatment, such as access to suitable forage crops and a run-off from these on fresh clean short pasture.

Care of Pastures.

Top-dressing and harrowing as discussed in these notes in recent months may still call for attention.

At this season newly established pastures require careful treatment, the essential feature of which is the avoidance of the extremes of under-grazing and of overgrazing. To keep the young growth appropriately short, as a rule it is advisable to graze with a relatively large number of stock for a short time—this tends to obviate the severe selective browsing of the more attractive species which at times occurs under light stocking

with injury to the overgrazed species when such treatment is prolonged. Undergrazing is especially likely to be harmful when temporary species, such as Italian rye-grass, are prominent in the pasture; temporary species, if not checked, tend to outgrow and consequently to injure the slower permanent species by shading. When the soil is soft because of rain special care should be taken with young pastures to avoid "poaching," which facilitates the ingress of weeds.

Liming.

In last month's notes it was pointed out that field investigations do not always provide evidence that would justify recommending the use of lime, but, when it is considered that liming is advisable, it may be carried out suitably in April or May. If separate dressings of lime and an artificial fertilizer, such as superphosphate, are to be applied within a short interval, it is considered preferable to apply the lime before the fertilizer, as this allows time for the lime to become incorporated with the soil, which is believed to obviate certain undesirable chemical changes that at times may occur when fertilizer is applied in the absence of lime. If desired, as a labour-saving practice, superphosphate and ground limestone (carbonate) may be mixed and applied as one dressing, but, as a rule, superphosphate and burnt lime should not be mixed on farms unless it is known that the mixture will be applied immediately.

Normally, lime readily makes its way downwards in the soil, and, especially in districts of good rainfall, tends to be washed away and lost to crops. Hence, in general, the working of lime into the soil is not only unnecessary, but also disadvantageous in that it hastens the loss.

In general, in the case of materials of a satisfactorily high degree of purity, approximately 2 tons of ground limestone are equivalent in their ultimate effect on the soil to 1 ton of burnt lime. This fact, which should be the basis of comparison of the cost of these two forms of lime, is also of considerable importance when the cost of the carriage of lime becomes heavy. If land is not especially in need of lime, then heavy cost of carriage may readily make the advisability of liming very doubtful. Probably the matters of greatest current moment relative to liming are (1) the continued tendency to substitute lime wholly or partly for phosphates on farms about which there is no evidence that this practice, which is adopted merely as a means of reducing outlay, is sound, and (2) the failure to use lime adequately on those farms which would respond profitably to free use of limes. Farmers who have not definite knowledge of the effect of lime in their district may obtain all the available knowledge from local officers of the Fields Division.

—R. P. Connell, Fields Division, Palmerston North.

THE ORCHARD.

Autumn Spraying of Stone-fruit Trees.

To secure a satisfactory control of leaf-curl on varieties particularly susceptible to attack by this disease, it is necessary that two applications of a fungicide at winter strength should be made. Better control of other fungous diseases can also be secured by two such applications. These sprays can be applied either in the early winter when about 50 per cent. of the leaves have fallen, and repeated in the spring at the bud-movement stage of growth, or alternatively the two sprays can be applied in the spring, the first at early bud-movement and the second from seven to ten days later. Owing to the risk of wet weather interfering with spraying operations in the spring, it is a good practice to make the early winter application. The fungicide recommended for this purpose is Bordeaux mixture at a strength of 5–4–50.

Silver-leaf and Fireblight.

Trees which are affected with silver-leaf and which are to be destroyed should be either removed forthwith or marked in some very conspicuous way, as affected trees are readily overlooked once the foliage has fallen.

In orchards where fireblight was prevalent during the past summer, a minute inspection should be made as early as possible for cankers, preferably before the foliage has fallen. Dead leaves frequently indicate where infection has taken place and lead to the finding of cankers that otherwise might pass unobserved. If this work is left until the trees are being pruned, there may be no dead leaves then remaining and cankers can pass readily without being detected. Where limbs have been removed during the summer on account of fireblight infection, the cuts should be examined closely to ascertain whether the infected part has been removed entirely and whether any further infection has taken place through the wound. It should be borne in mind that one small canker left to over-winter is capable of reinfecting a whole locality with fireblight during the next blossoming period.

Drainage.

Adequate drainage is one of the most essential factors in maintaining healthy trees. The effects of an inadequately drained soil are reflected in the general unhealthy appearance of the trees. Roots of trees will not tolerate indefinitely a saturated soil condition, and as the roots of mature trees penetrate to a considerable depth it is necessary for good drainage to be provided for at least 4 ft. or 5 ft. from the surface. Considerable mortality amongst mature trees is occasioned each year as a result of a condition known as sour-sap. While this trouble sometimes occurs in well-drained soil, it is more often due to inadequate drainage of the sub-soil. The cleaning and deepening, where necessary, of all open drains should be attended to each season before the wet winter conditions set in.

In portions of some orchards it may be necessary to lay further drains. In doing so, points to be considered are—adequate depth, sufficient fall the full length of the drain, and the avoidance of sharp angles. In a retentive soil, ready access for the surface water to the drain is imperative; therefore, if pipes are used, they should be covered with clean rubble or scrub. A retentive soil placed in direct contact with the pipes seals the spaces between each pipe section, and thereby prevents the surface water reaching the drain.

New Plantations.

Where new plantations are contemplated, the provision of adequate shelter belts is of the utmost importance. Where possible, such belts should be planted at least one year before the orchard trees. The cultivation of the soil during the previous summer and autumn and the provision of good drainage are also most desirable.

In those localities where such conditions obtain, and the soil is not of a retentive nature, planting can be done during the month of May provided the soil is not in a very dry condition. Under less favourable circumstances spring planting is recommended. The order for trees should be placed with a reliable nurseryman as soon as possible. The distance apart for planting must be governed by the nature of the soil, the kind and variety of the tree, &c. Where vigorous growth is to be expected, consideration must be given to the tendency noted in recent years for the encouragement of large trees by variations in methods of pruning. Where such conditions are likely to obtain, many varieties of apple, pear, peach, and nectarine should be planted up to 24 ft. or 26 ft. apart, while under different circumstances a distance apart of about 20 ft. will generally suffice.

On arrival from the nursery the young trees should be immediately unpacked and dipped in a solution of red spraying oil (1–10) as a safeguard

against any insects or insect eggs that may be present on the trees. They can then be heeled in singly in a trench made for the purpose, taking care to cover the roots thoroughly with damp and well-pulverized soil to prevent drying-out.

Pruning.

All fruit-trees (excepting citrus) require systematic pruning each winter if the best results are to be secured. This work should be commenced as soon as possible after most of the foliage has fallen. Stone-fruit trees are ready and should be pruned before pome-fruit trees. In localities where mild winter temperatures are experienced the trees should be completely dormant before pruning is commenced, as early-pruned trees are liable to be excited into premature growth.

Further and more detailed advice on pruning will be given in these notes in the next (May) issue of the *Journal*.

—P. Everett, Orchard Instructor, Gisborne.

Citrus Notes.

Those who have established groves and contemplate increasing their area by fresh planting should have their trees ordered from the nurseryman in plenty of time beforehand so that they may get the pick of the trees, for only the best developed trees in the nursery will continue to grow the best when planted out in the orchard, provided that the conditions there are favourable.

In laying out new groves advantage should be taken as much as possible of any natural shelter, and if the soil is not naturally well drained steps should be taken to drain it artificially, for it is useless to attempt to grow citrus trees in soil waterlogged and lacking adequate shelter from cold winds. Shelter-belts should be all established several seasons before the trees are planted out so as to ensure a good start.

The condition of the soil plays a very important part in the establishment of a citrus orchard, and so thorough cultivation of the land selected should be undertaken some considerable time before planting. Liming well, and the ploughing-in of a cover crop, especially in land that is at all inclined to be heavy, will assist materially in the breaking-up and sweetening of the soil in subsequent cultivation.

The more time and labour spent in the preparation of the land the better will be the results obtained when the trees are planted out.

In selecting trees all indifferently grown and stunted ones should be discarded, as only the best may be expected to give the best results. Spring planting is preferable to autumn, as there is less likelihood of the young trees being checked by frost and more time is given for the land to sweeten, and winter cultivation can be undertaken if necessary.

—L. Paynter, Orchard Instructor, Auckland.

POULTRY-KEEPING.

Colds and Roup.

THIS is a period of the year when colds are often contracted by the birds, and especially pullets which have been hatched at a late date, so that a careful watch should be kept for any birds showing the first symptoms of being affected with this trouble. Such symptoms are sneezing and running at the nostrils, to which dust and dirt adhere, while in severe cases the discharge will be found on the feathers under the wing, owing to the birds sleeping with their heads thereunder. Where any of these symptoms are observed, the first essential step is to find the cause of the trouble and remove it, as with most troubles affecting poultry it is practically futile to try to cure colds if the cause is not found and removed.

Colds are the forerunner of that deadly disease, roup, which is one of the most difficult diseases that the poultry-keeper has to contend with, for if it once gets a good foothold the whole of the flock may become affected in a short space of time. Colds are caused most commonly by compelling the birds to sleep in an ill-ventilated or draughty house, while exposure to rain, and damp, over-crowded quarters are often responsible. Special care should be taken that the partitions dividing the house are absolutely airtight, and therefore the intersecting walls should be made of some such material as asbestos slate, beaver-board, &c. If the partition is to have the desired effect, particularly in exposed conditions, it should extend the full width of the house, and not merely a few feet from the back wall. Although plain 1 in. boards are commonly used for partitions, they are unsuitable for the purpose, for the reason that they can seldom be regarded as absolutely draught-proof. Where a neglected cold has developed into the dangerous roup, at which stage the breath becomes offensive, while usually one eye becomes swollen and finally a cheeselike substance protrudes from it, little or nothing can be done for the bird, and usually the best course is to destroy it and burn the carcass.

The Moulting Period.

A common weakness in the system on many poultry plants at the present time is to reduce the ration of the adult stock merely because they are on the point of or are going through the moulting process and therefore not in a laying condition. This short-sighted policy is to be deprecated, for it is not only cruel, but decidedly unprofitable. It should be remembered that during moulting the bird's system is taxed to the utmost in producing the new crop of feathers, which must necessarily come from the food she eats. Especially is this the case with the heavy layer that has just finished an exhaustive laying period. If her next season's laying is to be profitable, it is therefore imperative that she be given ample food in order to recoup her strength and resume laying in the shortest time. For the moulting bird there is nothing better than the usual diet, making sure, however, that ample green food is provided. Maize may be added to the grain ration, and the morning mash should be made as appetizing as possible by mixing it with boiling water or preferably milk. In addition to receiving liberal feeding, the birds should be well housed, and, above all, they should not be subjected to draughts. It is also necessary to protect them from exposure to cold and wet weather. They should not be compelled to stand in a cold wet yard waiting for feeding-time, as such exposure of a half-naked bird must obviously have an undesirable effect on it. As is the case with birds of all ages at this time of the year, they should be fed in the house, so that they will secure all the food they require without having to go out into the open on cold wet days. If the moulting bird has been considered sufficiently good to retain in the flock for another year, then she certainly deserves to be well treated, even although she is temporarily unproductive. The amount of attention she receives now largely influences the time at which the productive season again commences.

Scaly Leg.

A subscriber is anxious to know the cause of and how to prevent scaly leg on his fowls. Scaly leg is found usually on the legs of fowls improperly managed, and particularly those kept in dirty quarters. It is caused by a minute parasite which breeds under the scales of the unfeathered portion of the bird's legs and the upper part of the toes. The parasite there irritates the tissue by attacking with its strong mouth-parts, and as a result of its activity in this way large scaly masses which appear give the bird a most unsightly appearance. Usually the parasite attacks both legs at the same time. This trouble not only gives the bird a most unsightly appearance, but also affects its general health and its production

as well chiefly because of irritation and loss of rest while roosting. There are many methods of treatment, but one of the most simple and rapidly effective is to apply a mixture formed of equal parts of sulphur and lard, to which has been added sufficient pure kerosene to make the whole into a more or less liquid form. This should be mixed in a fairly wide but shallow tin or similar vessel. When treating a bird a good plan is to kneel down, having the tin containing the mixture right opposite. The head and fore parts of the body are placed between the knees to prevent the bird from struggling. The legs are held in the left hand, the right being used to run the mixture well in with a piece of soft cloth. Care must be taken that it reaches the deepest parts. The treatment should be repeated weekly until a cure is effected.

Scaly leg should never be neglected, as from one affected bird it will soon spread through the flock. A common misconception is that scales on the legs are an indication of advanced age in a bird. Certainly the trouble is rarely seen in very young chickens, but it is quite common in young pullets even before they commence to lay. Many good pullets have been considered old hens and sent to market simply because there was some scale on their legs. Chicks always should be marked in the web of the foot when young, and by keeping a register the age of a bird can at once be ascertained. With scaly leg, as with the bulk of troubles that affect poultry, the only sure remedy is prevention, the essential factor of which is cleanliness.

Leg Weakness in Growing Cockerels.

This is one of the many troubles affecting poultry in which prevention is the only satisfactory course. The invariable cause is insufficient exercise and a too liberal supply of over-forcing foods. In the case where cockerels are intended for breeding purposes, forcing food and confined quarters at this stage are a mistake. Too often after the most desirable cockerels are selected for breeding purposes, they are placed in a small coop or run without any of the requirements which tend to promote good health and vigour. A growing cockerel may be ever so healthy and possess ever such a strong constitution, but if subjected to such treatment it well may be expected that the bird's vigour will be impaired. In the case of breeds with large combs, such as Leghorns, Minorcas, &c., leg weakness usually is accompanied by a falling-over of the comb. Confinement with insufficient room to exercise and an over-supply of rich food cause extreme development of the comb, and a consequent falling-over of this ornamental feature by reason of its extreme weight. Where birds are to be marketed young and in prime condition, forcing food as well as confined quarters is necessary in order that the birds may make the greatest growth possible in the shortest space of time. The highly forced male, however, is not one to be regarded as a desirable bird for heading the breeding-pen. The fact that a bird is weak in the legs indicates that it has been weakened through improper management, or that it possesses an hereditary weakness as a result of an impaired constitution. Once a bird becomes affected in this way it is useless to try to correct it: prevention is the one thing to aim at. The essentials for this purpose are breeding from only healthy parents, giving the young birds an ample supply of plain but nourishing food, and a liberal range under the most natural conditions possible. Further, if leg weakness is to be prevented and the young birds are to have the desired thickness and quality of bone, it is imperative that the growing stock, whether cockerels or pullets, be well provided with broken sea-shell throughout all stages of their development as a means of supplying the necessary lime for the manufacture of bone and other bodily requirements.

—F. C. Brown, Chief Poultry Instructor, Wellington.

THE APIARY.

Winter Work.

DURING the dormant season mice are likely to make themselves troublesome in the apiary. They attack the stores, and otherwise destroy the combs. Many colonies by this means are reduced to the verge of starvation by the spring. It is the work of only a few minutes to examine the hives, and where gable roofs are adopted the mice-nests will usually be found on top of the mats. To obviate this trouble the entrance should be contracted.

Control of Wax-moth Pest.

In districts where wax-moths are troublesome, particularly the large one (*Galleria mellonella*), a periodical examination should be made of all extracting combs. These moths do an enormous amount of damage, particularly in the off season, and especially in districts where mild weather conditions prevail. The moths attack not only the dry combs, but also combs of honey stored for spring feed.

Where the moth is prevalent in large numbers it is essential to have a special comb-room, constructed so as to be nearly airtight and filled with racks on which to suspend the combs to enable fumigants to penetrate the cells. Where only a few combs have to be dealt with these may be stacked in supers, spaced eight to the super, care being taken to see that the junctions of the boxes are made smoketight by pasting a strip of paper round them. The top box of the pile should contain no frames. Into this it is necessary to place an iron saucepan containing wood embers, and on these to throw a small quantity of sulphur. The supers should be closed securely, and kept closed for a couple of days. In from three weeks to a month a second fumigation should be given.

Bisulphide of carbon may be used to accomplish a similar result. In using this chemical the combs may be stacked in a tight box or supers. If the latter are used all cracks require to be closed with paper pasted on the outsides to prevent the fumes from escaping. A quantity of the bisulphide should be placed in an open dish on top of the combs. The liquid evaporates and the fumes, being heavier than air, settle over the combs, thus effectively killing the moths. This operation may have to be repeated during the winter months. Great care must be taken when using the bisulphide, as it is highly explosive and dangerous, and on no account should a fire or light be allowed near the liquid when being used.

For the efficient control of the wax-moth, Cyanogas (calcium cyanide) may be used, and is more effective than the fumigants previously mentioned. The active agent of calcium cyanide is liberated in the form of hydrocyanic acid gas, which is a most deadly poison to all life. However, it can be used with safety because the liberation of the gas from the powder is slow, thus allowing the operator to retire after giving a charge. Fumigation of combs may be done in supers, after taking the precaution of making them gastight, in the same way as when using sulphur or bisulphide. The calcium cyanide should be sprinkled finely on newspaper, and the dosage placed at the bottom of the stack. In the event of a comb-room being used, the supers containing the combs may be stacked criss-cross or placed on the racks usually provided No other preparation is necessary. In operation the calcium cyanide powder should be sprinkled on paper and placed here and there about the comb-room. For super fumigation the recommendation is to use a dose of 4 lb. to 1,000 cubic feet of space. Half the quantity will suffice for airtight comb-rooms. These dosages will kill the moths in all stages. As already indicated, the gas, being deadly to all life, should be handled with great care. The writer has used calcium cyanide in the open air for killing bees and has watched its deadly results. Caution, however, is necessary when the chemical is used in buildings. The operator should leave the building

as soon as possible, and lock the doors and windows. Twenty-four hours' treatment will suffice, after which the door of the room should be opened to allow the gas to escape, and the building should not be entered for from two to three hours.

There is no danger of poisoning honey in ordinary fumigation with calcium cyanide; consequently combs of honey stored for spring feed when attacked by the wax-moth may be fumigated in a similar manner to dry combs, and the combs of honey so treated may be fed without injury to the bees.

Plans for next Season.

The off season is the best time to make plans for the following season. The beekeeper should decide what increase he desires to make, and should prepare accordingly. Making up hives and frames is exasperating work if left till the bees are in urgent need of room, and it should be finished long before the actual time for increasing one's stock arrives. The beekeeper should also face the question of providing himself with stocks of foundation, and make arrangements for the treatment of his surplus wax by some neighbouring maker of foundation. He should also decide on which market to place his crop, and lay his plans accordingly. It is advisable, too, that he consider the theoretical side of his occupation, and study, while the bees are in a dormant condition, the best methods of improving his stocks. Neither weather conditions nor locality nor any other factor influences the honey-crop so much as strong colonies of bees, and the apiarist should endeavour, while he has the time, to ensure that these shall be in existence during the coming summer.

—E. A. Earp, Senior Apiary Instructor, Wellington.

HORTICULTURE.

The Planting-season.

WELL thought-out plans for the establishment of shelter-belts, hedges, and shade trees and for plantations for the supply of firewood and posts, and the control of watercourses, may be carried out during the planting-season for hardwood plants which extends from the months of May to September inclusive. In warm districts the season for the removal of deciduous plants may be somewhat delayed owing to the shorter dormant period, also in the drier localities late planting has rather serious risks.

Plans for such permanent improvements require leisurely consideration over an extended period, so that consideration is given not only to one's own tastes but also to the suitability of the plants for the locality and purpose in view, and also to the arrangement, extent, and position of each feature. Where this has been done and the land given what preparation may be necessary and fenced off from stock, the plants may be set out as soon as possible in fine weather with excellent prospects for a good start. Where the land is wet and cold at midwinter, planting should not be done at that period, and, where plants are small and somewhat tender, planting in spring is to be preferred.

In any case where the plants are to be purchased it is advisable to take delivery as soon as they are available, and if they are not planted immediately they should be "heeled in" in a piece of friable soil that is well drained and conveniently placed. This is done by opening a trench and setting the plants in it close together, then returning the soil and treading it firm. In this position they will keep their condition and be available for planting out at any time during the season. If the plants have come a long distance they will be tied in firm bundles and may be somewhat heated, in which case they should be released and allowed to air in a well ventilated shed for twenty-four hours before "heeling in." During this period the roots should be moist and covered to prevent them drying excessively.

Plants generally selected for these purposes are redwood (*Sequoia sempervirens*), Douglas fir (*Pseudotsuga Douglasii*), Lawson's cypress (*Cupressus Lawsoniana*), macrocarpa (*Cupressus macrocarpa*), Bentham's Cypress (*Cupressus Benthami*), insignis pine (*Pinus radiata*), prickly-cone pine (*Pinus muricata*)—all natives of the Pacific Coast of North America. Also to some extent and quite successfully on a clay soil use is made of the Japanese cedar (*Cryptomeria elegans*). These are all fine conifers giving excellent results when planted in suitable, well-drained positions. On a rich deep soil macrocarpa and insignis pine become so coarse as to be of little use for timber or shelter; on land with a high water-table they are also unsatisfactory. Clay soils unsuitable for Lawson's cypress may be planted with Bentham's or the Cryptomeria; and to assist in forming a close margin the prickly-cone pine is often useful on account of its heavy foliage.

There are also the species of Australian eucalyptus which hardly can be excelled for firewood and posts. *E. Macarthuri* and *E. viminalis* are most popular, as they are of quick growth and hardy, and the timber has good lasting qualities. For alluvial land inclined to be wet and sometimes flooded species of willow and poplar are most suitable for providing shelter and shade.

For farm hedges barberry (*Berberis vulgaris*), boxthorn (*Lycium horridum*), and *Elaeagnus japonicus* are most frequently planted—the last only on a comparatively poor soil where it is useful in affording shelter at ground-level in a plantation.

Native evergreen shrubs hardly fulfil the requirements of a stock-proof hedge, but for good shelter up to about 15 ft., especially by the seaside, the native olearias and pittosporums, planted about 3 ft. apart, are most effective and require little attention once they are established.

For shade trees or an avenue, sweet chestnut (*Castanea sativa*), or, in good alluvial land in a dry district, the walnut (*Juglans regia*), serve very handsomely, and also provide a useful crop of nuts.

For the establishment of hedges and shelter-belts, the land should be in a good state of cultivation, and maintained in that condition for a few years to obtain the best results: on steep broken country the growth of natural herbage is generally less vigorous and trees establish themselves satisfactorily without such good preparation, which, in any case, is practically impossible under the circumstances. For successful planting it is indispensable that the land be sufficiently dry to be friable; the plants should never lie with roots exposed to the air and light, and they should be planted to the same depth as they have been grown, and, lastly, the soil placed about the roots of the young plant must be made thoroughly firm by treading.

When conditions are suitable for planting it is advisable to lift the plants and examine them critically: young yearlings that have been "wrenched" or grown in boxes will require no pruning: others may have straggling roots which should be shortened back. Older plants very possibly have roots that are bruised or broken; these should be trimmed back to sound growth with sharp shears and straggling roots should be shortened. Where branches are crowded, at the main forks especially, those awkwardly placed should be cut out completely and neatly. After these attentions the plants are packed, with plenty of wet hessian protecting the roots, and conveyed to the site where the planting is to be done. For stock-proof hedges the plants are set from about 12 in. to 15 in. apart. A single-line shelter of cypress, olearia, or pittosporum may be planted 3 ft. apart where a height of about 15 ft. is desired: that spacing is also suitable for Lombardy poplar, although it is often planted 2 ft. apart where shelter is not required much over 20 ft. in height. In a shelter-belt of greater width the trees may be planted alternately, at a distance of 6 ft. or 8 ft.

There are different methods for planting broken country, but it is often useful to plant along a line indicated by 6 ft. sighting rods driven into the ground at intervals. It is advisable to skim the turf off an area about 2 ft. square on this line, break up the ground with the spade, which is afterwards driven in deeply and vertically, and then levered to one side while an assistant places a tree in position and makes the soil firm about it by treading. The distance to the next planting site may be measured with the spade and the action repeated. When a sighting rod is reached it is necessary to measure the distance carefully to the right or left and the line will be laid for the next row. Plants left over at the end of the day should be "heeled-in" carefully on the spot, so that if wet weather, &c., should stop the work for a while there will be no loss.

Small and Sundry Fruits.

In this country bush-fruits are planted among tree-fruits to only a very limited extent, and rarely can such planting be recommended. It may be done with advantage sometimes when establishing the home orchard in order to obtain a return while the trees are becoming established. When deciding on the kinds for planting it is necessary to consider the demand for the crop, both for domestic and commercial purposes; then comes the consideration of the suitability of the climate, and of the soil and of the preparation of the soil. Gooseberries, currants, and raspberries thrive best in the cooler districts, an open situation and rather light land suiting gooseberries and red currants, whilst black currants and raspberries require a good loam where moisture is always present as well as good shelter from prevailing winds. To be avoided carefully is the planting of these bushes in the vegetable garden, even on its verge, as their interests clash with those of vegetables. The deep cultivation required for vegetable crops is injurious to the fibrous roots of the bushes, and the shade and competition of the bushes is detrimental to the vegetable crops. These berry crops are generally best planted in a block in a section of the home garden specially reserved for perennial crops, such as asparagus, rhubarb, and herbs, as the plants named have very much in common and there is little chance of their doing one another an injury. Commercial crops are set in a well-hedged paddock with probably high shelter on the weather boundary. The distance between rows and plants will vary with the quality of the land and the variety being planted, but for gooseberries and currants it should not be less than 5 ft. For black currants and raspberries it is generally advisable to plant the rows 6 ft. apart and 3 ft. between plants, the raspberries being planted in groups of three canes. A very good alternative method of planting raspberries is to set the canes singly 1 ft. apart in the row.

In the warmer localities most of the following fruits may be grown on suitable land: The Cape gooseberry (*Physalis peruviana*) is a herbaceous plant cut down by frost in winter, but shooting again from the crown in spring. Good forward plants set out 3 ft. apart and 6 ft. between rows, in a light, rich, warm soil, during the early part of November should crop well during the autumn for two or three seasons. The tree-tomato (*Cyphomandra betacea*) is enjoying an increasing popularity. This half-woody plant with large soft leaves grows here usually to a height of about 6 ft. It should be planted about 3 ft. apart in a fertile soil with ample shelter. The crop ripens in winter when not many kinds of fruit are available. The guava and also the feijoa are fruiting-shrubs from the warmer parts of South America. Planted as informal hedges in the less exposed positions they should crop satisfactorily if the soil is good and care has been taken in the choice of varieties. Seedling plants may be bought cheaply, but they are rarely so good as selected varieties grown from cuttings, &c.

The Chinese gooseberry (*Actinidia chinensis*), the passion-vine (*Passiflora edulis*), the loganberry, and the grape-vine are all vines requiring support,

which usually takes the form of a post and wire fence from about 4 ft. to 5 ft. high, but a wall with strained wires at intervals or a pergoda is very suitable for the purpose in the home garden. As the *Actinidia* is commonly dioecious—that is, it has staminate and pistillate flowers on different plants—both kinds must be planted to produce fruit. In a rich, moist soil the fruit is produced fairly abundantly, and ripens in winter.

Fruiting-trees of moderate to fair height and suited to a mild climate are the loquat (*Eriobotrya japonica*), the avocado (*Persea gratissima*), the olive, the fig, and the pomegranate. The first three are evergreens and the remainder deciduous, but they are alike in requiring a light, deep soil. A number of unsatisfactory trees of the kinds above mentioned are growing in many parts of the country. In a few instances the soil or climate may be unsuitable, but, generally, poor results are due to the fact that the trees are seedlings and comparatively worthless under any conditions, or the variety is not suited to the locality. Planting as a rule should not be done unless the variety has proved itself suitable to the locality or to one very similar. The avocado is indigenous to Mexico and Central and South America, but is now distributed in most tropical and subtropical countries. Those varieties likely to do best here are those derived from varieties growing in Mexico, where, growing for centuries at an altitude of from 6,000 ft. to 7,000 ft., they easily withstand fairly sharp winter frosts. The introduction of some of the trees mentioned has not been carried sufficiently far to warrant commercial planting at present, but selected varieties are certainly worth a place in the home garden, as their beauty and utility are considerable.

Apples and pears, stone fruits, and citrus are dealt with under another heading in this *Journal*.

The Homestead Garden.

In the established garden the planting-season affords an opportunity for considerable rearrangement of trees and shrubs, if that is necessary, or for supplementing plantations and borders, especially with plants which require the shade and shelter of well-established growth in the vicinity. The planting season is an opportunity also to try one or two novelties about which reports have been good, to see how they respond to local conditions—*e.g.*, one or two new roses that have received awards, a new bougainvillea, or a few of the new hydrangeas, barberries, or brooms.

In the case of the new garden the planting-season is all important: it will be best to confine attention almost entirely to well-proved material, for really good effects with trees and shrubs that have not been proved under local conditions are unlikely. With very few exceptions, it will be wise to confine the planting, for a few years, to trees and shrubs of known worth. One principal that may be laid down definitely is that the shelter and shade trees chiefly should be of native evergreens, and that some of the characteristic plants such as tree-ferns, nikau-palm, cabbage trees, toetoe, and flax should sooner or later find a place. For the New Zealand landscape and climate nothing can altogether take the place of the native plants: even if we accept a charge that they are sombre, which they are not entirely by any means, native evergreen trees and shrubs of shapes, sizes, and shades make an indispensable shelter and background for such favourite flowering shrubs and trees as rhododendrons, azaleas, roses, cydonias, syringa, philadelphus, forsythia, camellias, weigelia, daphne, broom, magnolia, fuchsia, and hydrangea. The most interesting garden perhaps is one where the number of genera is lower than usual, and the number of species is increased; or, stating it another way, fewer kinds of shrubs and more varieties or species of those kinds.

—*W. C. Hyde, Horticulturist, Wellington.*

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

MORTALITY IN YOUNG PIGS.

C. B., Westport :—

Ten pigs born at the beginning of December seemed to have nothing wrong with them, being very fat and healthy looking. Three died through Christmas week, three last week, and one this morning.

The Live-stock Division :—

The cause of death amongst your young pigs would appear to have been of a dietetic nature. The sow herself may have been at fault in not providing sufficient nourishment. Has she raised a large litter successfully before? Again, the food supplied may have been an unbalanced ration for a sow to rear successfully a large litter. The mortality of the seven young pigs having occurred over a period of three to four weeks is an indication that the trouble was caused by some digestive disorder, and was not due to heart trouble as you were advised.

REMOVAL OF GREEN DISCOLORATION OF WATER.

C. McL., Waipu :—

After standing in the tank for a day or two, artesian water possesses a green tinge, and after standing in the concrete troughs of 300-gallon capacity for a week the water becomes very discoloured by minute green "particles," and is not suitable for watering stock. The water is crystal clear when pumped. Is there any means of preventing the growth of the green particles?

The Chemistry Section :—

Green growth in water cannot take place in the absence of daylight. Hence if the pure water is pumped into a tank from which light is excluded and fed into troughs where the light is partially excluded there will be no discoloration by minute green "particles," which are merely a low form of plant.

EARLY WEANING OF FOAL.

J. W. D., Methven :—

It is desired to wean a well-grown draught foal (dropped 1st October, 1934) as early as possible in order to get use of the dam, but this without prejudice to the foal, which will eat hay, chaff, &c., as it has eaten such with the dam. Foal is in very good condition and the picture of health.

The Live-stock Division :—

Usually foals are weaned when about six months old, but when the mare is required for work they can be weaned at an earlier date. As the foal is already accustomed to chaff, &c., she could be weaned in March. In order to treat her well it would be advisable to add a little crushed oats and bran to the chaff, which should be given in small quantities three or four times a day in addition to the grazing that is available. Plenty of fresh water is also necessary for young stock.

ADVISABILITY OF STRONG HIVES IN WINTER.

Amateur, Mangamingi, Eltham :—

Why is it advisable to have strong hives to start the winter? I understand that the worker bees now in the hive do not survive to do any useful work next summer. So why feed the whole lot—if a number were killed it would leave more food for the spring?

The Horticulture Division :—

In temperate and colder regions there is a period of quiescence in the winter with close clustering of the bees, subject in the cold weather to periodic

disturbance for raising of the temperature. When the surrounding atmosphere in the hive is low enough to cause danger to the life of the bees, then extra heat must be generated and pass from within the cluster to maintain the temperature of the bees on the outside. The closer the cluster the better is the heat retained and the smaller the external surface. The mass of bees and heavy old comb and of any stores within the cluster has considerable heat storage capacity, but the heat has to be maintained by the combustion of food in the bodies of the bees within the cluster. A strong hive with a larger number of bees has less external surface for a given volume than has a weak hive with fewer bees. If the number of bees is halved the amount of external surface of the cluster relative to the number of bees is increased, and more heat must be generated per bee to keep up the outside temperature. Moreover, the air will pass more readily through a small cluster than a large one, and it seems that this considerably intensifies the burden of maintaining the temperature in a small cluster. The saying that the best packing for bees is bees has its justification in practice and theory. The young bees reared in the autumn survive the winter period and are essential to the life of the colony in the spring, maintaining their activities until sufficient young bees are reared to ensure the colony against death.

OAT VARIETIES, HARVEST OF 1934.

Simultaneously with the collection of particulars relating to wheat recorded on page 47 of this *Journal*, January, 1935, information was also obtained from proprietors of threshing-machines in respect of oats threshed by them. The figures relating to oats are shown in the following table.

Altogether, the threshing returns accounted for 73,270 acres of oats out of a total area of 78,343 acres ascertained to have been threshed for the season 1933–34.

Variety of Oats threshed.	Area threshed.	Total Yield.	Average Yield per Acre.	Per Cent. of Total Area.	Percentage of Total Yield.
	Acres.	Bushels.	Bushels.		
White	50,364	2,485,990	49·36	68·74	74·38
Dun	7,161	266,039	37·15	9·77	7·96
Black	2,364	97,122	41·08	3·23	2·91
Algerian	13,381	492,894	36·84	18·26	14·75
Totals	73,270	3,342,045	45·61	100·00	100·00

—*Census and Statistics Office.*

DAIRYING INDUSTRY, 1933–34.

DAIRY factories reporting operations during 1933–34 numbered 482, as against 478 in 1932–33. Persons employed in this industry totalled 4,346, or 5 per cent. more than in 1932–33, but salaries and wages paid receded a shade. The cost of butterfat purchased by factories—*i.e.*, pay-out—advanced from £13,498,797 in 1932–33 to £14,790,990 in 1933–34, an increase of almost 10 per cent. Milk and cream cartage costs increased by 7 per cent., and an advance of 14 per cent. is recorded for the cost of materials used. The value of products (based on the price ruling at the factory) rose from £16,612,981 in 1932–33 to £17,911,129 in 1934–34, or by 8 per cent.

Butterfat amounting to 391,961,202 lb. was sent to dairy factories during 1933–34, this quantity being 8 per cent. greater than for the previous year. Of this amount 75 per cent. was used for buttermaking and 24 per cent. was required for cheesemaking, while the remaining 1 per cent. was utilized for the manufacture of condensed and dried milk, &c. Butterfat for buttermaking, cheesemaking, and condensed and dried milk, &c., making during 1933–34 was 10 per cent., 3 per cent., and 1 per cent. respectively more than in the preceding year.

The quantity of butter produced during 1933–34 is the highest yet recorded, being 9 per cent. greater than in the previous year. The value of butter produced increased from £11,378,210 in 1932–33 to £12,521,267 in 1933–34, an advance of 10 per cent. Whey butter produced increased by 6 per cent. in quantity and 2 per cent. in value. Cheese showed an upward movement of 3 per cent. for quantity, but the value remained practically stationary.

WEATHER RECORDS: MARCH, 1935.

Dominion Meteorological Office.

NOTES FOR MARCH.

MARCH was a very satisfactory autumn month. The warmth and lack of wind led to rapid growth of vegetation, and a good supply of winter feed is assured. The only extensive area still suffering from a shortage of rainfall is North Canterbury. Parts of the Southern Wairarapa, also, are still dry. Stock generally are reported to be in good condition, and the milk-yield has recovered. There was much dull and damp weather in the first part of the month on the east coast of the North Island north of Hawke's Bay, and this had an adverse effect on sheep, a considerable amount of facial eczema being reported. Crops have done better than seemed probable earlier in the season.

Rainfall.—Except in the Auckland and Hawke's Bay Provinces, the first half of the month was very dry, but in the latter half there were general rains, with heavy falls at most places. In Central, and especially North, Canterbury the total rain was below average. Hawke's Bay and parts of the interior of the North Island also had less than normal. On the west coast of the South Island conditions were irregular, but on the whole did not differ greatly from average. Over the rest of the country there was an excess. Many places in North Auckland, Taranaki, Nelson, Marlborough, and Otago had double the average.

Temperatures.—Temperatures were again considerably above normal, the departures ranging mainly between 1·5° and 3·0°. The one exception was Hawke's Bay, where the mean for the month was below the average. Some snow fell on the mountains on the 26th and 27th, but most of it subsequently disappeared. A few light frosts were recorded.

Sunshine.—Sunshine was unusually abundant on the West Coast and in the far southern portions of the South Island. On the east coast of the North Island, from Hawke's Bay northward, there was a considerable deficit, and this probably accounted for the low temperatures in that area. Elsewhere the totals did not differ greatly from normal.

Pressure Systems.—In the first part of the month there was very little storm activity over the Dominion. On the 3rd and 4th a depression moving from the north past East Cape caused heavy rains north of Hawke's Bay and in parts of the Bay of Plenty area.

Between the 10th and the 14th a depression passed slowly by the northern extremity of the North Island, and was responsible for north-easterly gales and heavy rains in most of the Auckland Province. Very severe flooding occurred in North Auckland.

The first general rains were associated with a rather complex storm system which was active over the country from the 15th to the 19th, the 17th being generally the wettest day. Floods occurred again in North Auckland and Taranaki, while few districts escaped very heavy falls.

From the 12th to the 17th pressure was high to the east of New Zealand, at Chatham Islands, a state of affairs which had characterized the dry weather of the early part of the summer. After the 17th, however, there was a definite change, and weather of a westerly type has since predominated.

Further general rains occurred during the passing of another series of depressions between the 24th and 27th. Very heavy falls were experienced from Taranaki and Wellington southwards. Taranaki had its third series of floods within five weeks. There was some flooding, also, in Southern Otago and Southland.

Many thunderstorms were experienced during the month, especially in the Auckland Province, and some were very severe and prolonged.

Between the 19th and 23rd a tropical cyclone developed in the Pacific Islands region and passed through the Tonga Group in a south-easterly direction. Fortunately no serious damage was done.

RAINFALLS FOR MARCH, 1935, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average March Rainfall.	Total Rainfall to Date.	Average Rainfall to Date.
			North Island.			
	Inches.		Inches.	Inches.	Inches.	Inches.
Kaitaia	5·99	15	2·58	3·10	16·34	10·54
Russell	13·57	15	3·20	3·28	28·85	9·52
Whangarei	11·51	12	4·90	4·45	23·63	12·25
Auckland	4·38	15	2·02	3·02	16·24	8·86
Hamilton	1·79	10	0·60	3·76	6·92	10·24
Rotorua	10·78	13	4·62	3·49	18·58	11·44
Kawhia	5·26	10	2·90	4·21	13·26	9·83
New Plymouth ..	5·95	11	2·25	3·72	20·03	11·70
Riversdale, Inglewood ..	8·31	10	2·96	7·04	32·95	20·58
Whangamomona ..	6·38	6	3·59	4·98	26·48	14·45
Hawera	6·46	7	3·20	3·01	16·55	8·92
Tairua	10·36	17	1·90	5·21	21·74	13·55
Tauranga	8·50	14	1·30	3·98	13·15	11·57
Maraehako Station, Opotiki	5·97	10	1·39	3·96	14·40	11·69
Gisborne	3·90	11	1·48	4·42	9·91	10·60
Taupo	2·27	10	0·55	3·14	14·26	9·25
Napier	1·25	10	0·34	3·13	7·53	8·84
Hastings	1·58	10	0·58	2·76	6·34	6·94
Whakarara Station ..	2·41	15	0·52	..	12·04	..
Taihape	1·30	7	0·43	2·61	9·46	8·00
Masterton	1·05	7	0·31	2·81	5·53	8·14
Patea	4·43	10	2·20	3·35	15·53	9·34
Wanganui	2·68	8	1·11	2·47	12·66	7·72
Foxton	2·81	7	1·10	1·98	7·90	6·19
Wellington	3·79	8	2·31	3·11	9·06	8·59
			South Island.			
Westport	6·03	13	1·51	7·50	24·17	21·05
Greymouth	6·38	11	1·32	8·80	28·03	24·18
Hokitika	9·80	12	2·31	9·64	37·45	26·90
Ross	6·67	9	2·10	10·73	32·31	32·03
Arthur's Pass ..	14·29	7	5·00	13·19	47·43	37·21
Okuru, South Westland	13·24	7	4·35	14·15	44·12	36·40
Collingwood	9·45	14	2·73	5·81	17·96	17·68
Nelson	7·54	12	2·82	2·91	13·77	8·35
Spring Creek, Blenheim	4·16	8	2·23	1·98	5·80	6·38
Seddon	2·36	9	1·20	2·00	4·17	5·69
Hanmer Springs ..	1·83	7	0·54	3·20	7·72	10·30
Highfield, Waiau ..	1·27	4	0·54	2·84	4·88	8·42
Gore Bay	1·00	7	0·23	2·13	5·35	7·39
Christchurch	1·22	11	0·56	1·98	3·03	5·90
Timaru	1·98	6	1·21	2·20	6·59	6·31
Lambrook Station, Fairlie	1·78	8	0·94	2·34	6·36	6·58
Benmore Station, Clearburn	3·70	8	1·58	2·41	9·23	6·80
Oamaru	3·69	12	2·22	1·78	6·97	5·61
Queenstown	5·54	12	2·50	2·61	11·81	7·47
Clyde	2·33	8	1·39	1·49	5·94	4·40
Dunedin	5·73	14	2·67	2·94	11·17	9·10
Wendon	5·91	10	1·74	2·74	11·79	8·20
Balclutha	4·64	10	2·03	2·31	10·32	6·61
Invercargill	4·90	14	1·02	3·87	13·62	11·00
Puysegur Point ..	7·11	16	1·66	7·97	23·65	21·33
Half-moon Bay ..	4·44	20	1·03	5·37	13·61	14·27